

621319 Mitchell

Everything  
in  
Insulation



MITCHELL-RAND MFG. CO.

NEW YORK, N. Y.



Everything  
in  
Journals



# *Everything in Insulation*

No. 262

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MITCHELL-RAND MFG. CO.

Offices and Warehouse  
18 VESEY ST., NEW YORK, N. Y.

Factory and Laboratory  
JERSEY CITY, N. J.



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# FOREWORD

## EXPERIENCE

When one considers that electricity, with its countless uses, would be valueless were it not for the various non-conductors which confine the course of the electrical current, the paramount importance of insulating materials becomes evident. In most cases the successful application of electricity to a special use is absolutely dependent upon the selection of proper insulation. Our experience in the line of insulating materials dates back over a long period of experimental work, we having manufactured such products for more than thirty years.

## FACTORY

Our factory for the manufacture of Insulating Compounds is located in the Jersey Avenue Terminal of the Central Railroad of New Jersey, Jersey City, N. J., where we have our own trackage, providing unequaled facilities for procuring and handling raw materials promptly and at a minimum transportation expense. We have a properly equipped laboratory where we test all crude materials used, as well as all finished products before they are shipped, so that absolute uniformity of product is assured. We can make tests of materials you are now using and doubtless duplicate the results you obtain at a lower cost to you; our chemists are also at your disposal for making up new products from your own formulae.

## OFFICES AND WAREHOUSE

Our general offices and warehouse are located at 18 Vesey Street, New York City, one-half block west of Broadway, within easy access of the Hudson Terminal and all transportation lines.

An ample supply of all lines of insulating materials is carried at the New York warehouse, which is under the direct supervision of the Sales Department. Our customers will find this of great convenience over direct mill shipments, as it means a very large saving of time in shipping as well as in transportation.

Our Sales Department is completely organized to handle all sorts of insulating problems. We invite inquiries concerning anything in the insulating line, on which we can assure the lowest prices consistent with the high quality we have always maintained.

JD 89-08238 TCE



# ORDERS

## TERMS

Our terms (unless otherwise stated) are thirty days net to persons of satisfactory credit standing, and if account is not paid when due we reserve the right to draw at sight.

Orders from persons unknown to us should be accompanied by reference or New York draft or money order.

C. O. D. shipments will only be made if sufficient amount is sent with order to cover transportation charges both ways. We reserve the right to request an advance deposit on material made to order.

## PRICES

Prices in this catalogue, and all quotations are subject to change without notice and are F. O. B. our warehouse, unless otherwise agreed upon.

Always order by catalog description to avoid error.

Minimum Order Charge: \$1.50.

## SHIPMENTS

Where quotations are made F. A. S. New York City, delivery in Borough of Manhattan, below 14th St., is contemplated.

Always give shipping directions; otherwise we shall use our best judgment in making shipments.

Shipment of material in very large quantities, or of goods not regularly carried in stock, may be made direct from the factory.

Export packing and cartage, unless otherwise agreed upon, will be charged at cost.

We employ careful, experienced packers, and obtain receipts for all material forwarded in "good condition." If there is any damage in transit, make prompt claim on carrier. While we cannot hold ourselves responsible for damage or loss in transit, we are anxious to have all claims settled to the entire satisfaction of customers, and will lend full co-operation to securing adjustment thereof.

## SHORTAGES

We double-check all articles in a shipment to prevent errors and shortages. Claim for shortage should be made in writing immediately upon receipt of goods, accompanied by our packing memorandum which will be found in the package.

## RETURNING GOODS

No goods can be returned without our authorization. After receiving such authorization, ship according to our directions and mail memorandum invoice to us, mentioning our invoice number.

Observance of the above will save annoying delays and much correspondence.

We stand ready at all times to rectify any mistake that we may make, without cost to our customers.

## TELEGRAPH CODE

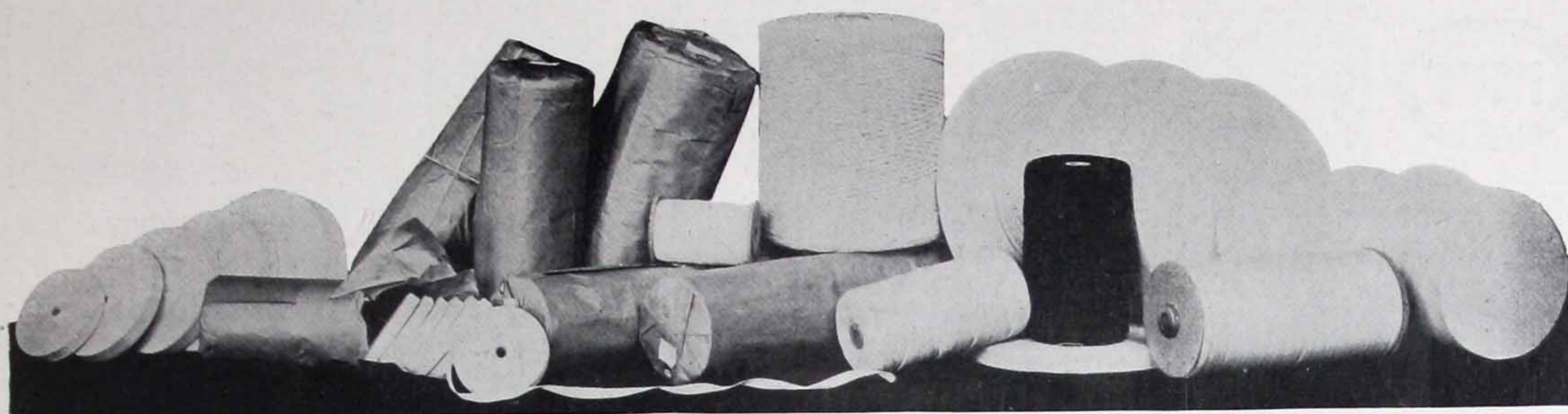
We have omitted code words for articles, due to the increasing use of night and day lettergrams, in which code words are not permitted.

Our foreign correspondents are urged to use the Western Union code. It not only permits of greater freedom of expression, but is also far more economical than any other code system.

Cable address: MITRANDCO, N. Y.



## TAPES AND WEBBINGS



As agents and representatives of the Hope Webbing Co., we carry in stock the full line of their electrical tapes and webbings, all of which we sell at no advance over prices prevailing at the mill.

Untreated tapes are used in winding coils for armatures and fields of motors and generators, coils of transformers and other electrical apparatus, both in manufacture and repair work, and are not affected by temperatures up to approximately 250° F.

While essentially non-conductors, tapes are employed as binders merely because of their tensile strength, and it is only the varnish, with which they are impregnated, that furnishes the insulation and which also greatly increases both the heat-resisting and dielectric properties of the tape itself. The more open the tape, therefore, the greater amount of varnish it will carry and the higher the insulation.

Tapes and webbings are invariably sold by the "gross yard" and never by weight. They are furnished in rolls of 1,  $\frac{1}{2}$  or  $\frac{1}{4}$  gross yards, the  $\frac{1}{2}$  gross yard roll being practically standard, although for coil winding machines the  $\frac{1}{4}$  gross yard roll is generally required.

Average weights per roll of $\frac{1}{2}$ gr. yd. (72 yds.)			
Width . . . . .	$\frac{1}{2}$ "	$\frac{3}{4}$ "	1"
Ounces . . . . .	4	6	8

## TAPE "SECONDS"

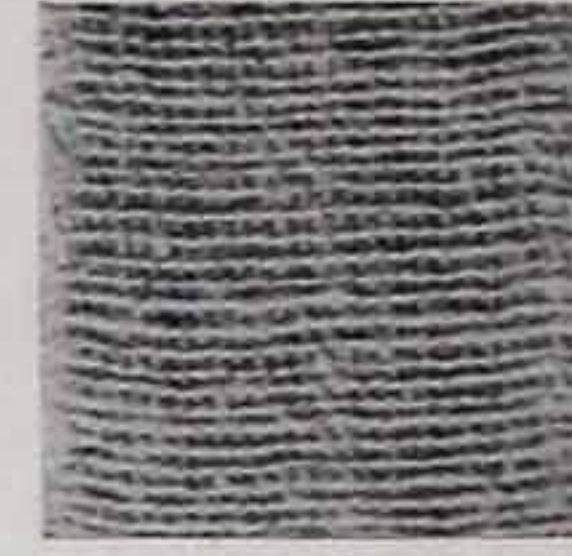
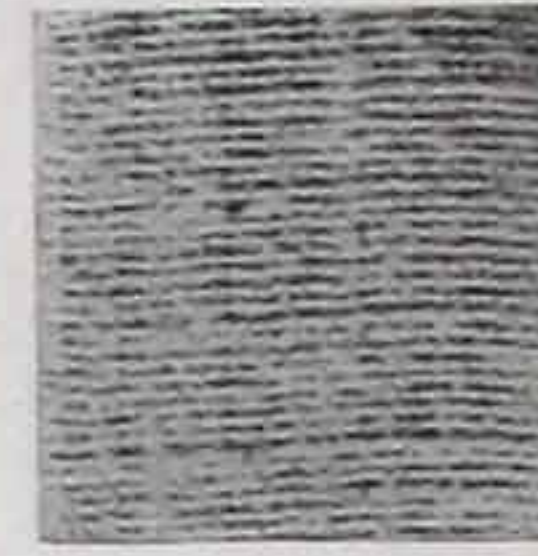
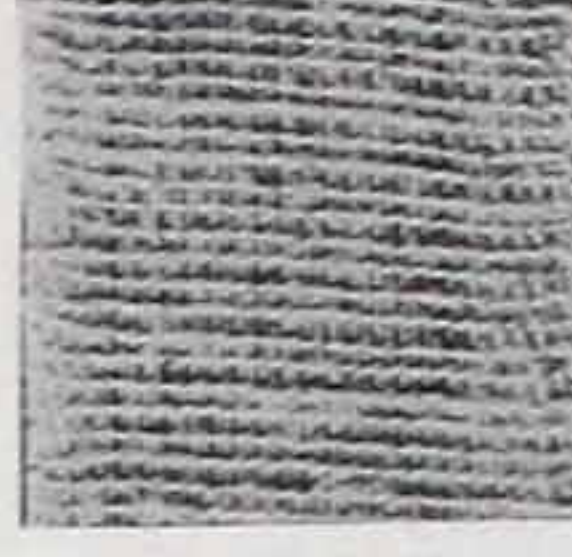
In the manufacture of electrical tapes, slight imperfections in weaving occasionally occur; "ends" are also accumulated which are either too long or short for standard 36 yard rolls, or too short for 72 yard rolls. This material is put up as "Seconds" in rolls of guaranteed yardage, the rolls differing from regular material only in consisting of two or three lengths instead of one continuous strip.

"Seconds" are all classed as "Special" or "13869 Grade" and are sold at regular current prices of "Special" less an additional 10% discount.

They offer a considerable saving for those who cut up tape for repair work and are even extensively used by many large concerns for regular manufacturing. Quality runs uniformly high and "Seconds" are strongly recommended where no serious objections are foreseen concerning the slight differences described.



## TAPES



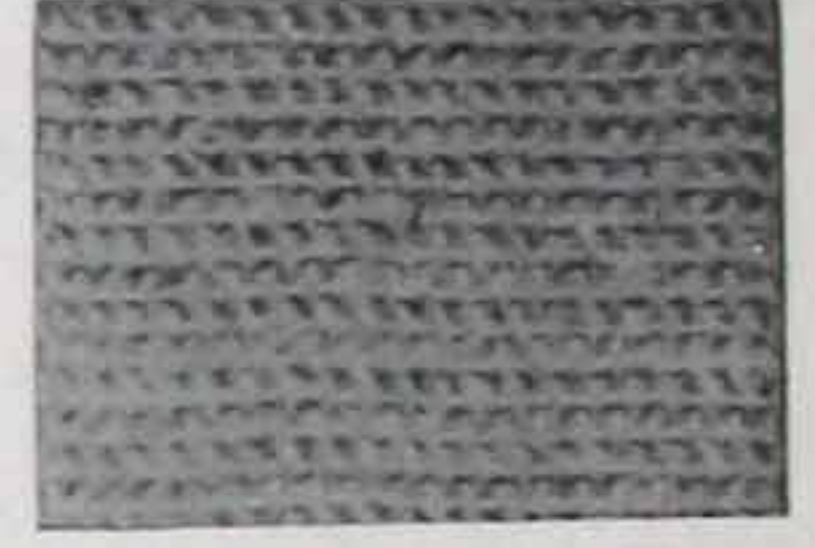
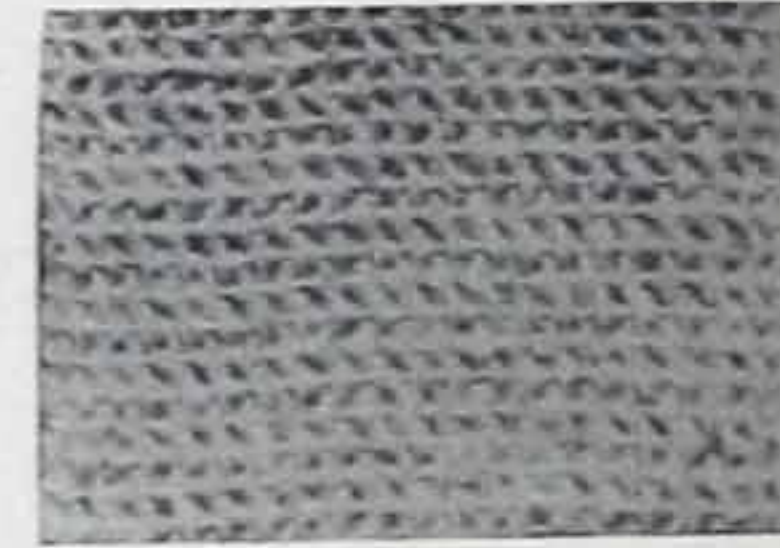
## LINEN FINISHED TAPES .007" THICK

Width	Extra	Special	Standard	Lightweight
		"SPECIAL" will supersede "STANDARD" which it resembles		
1/4"				
3/8"				
7/16"				
1/2"	23814 \$2.00	13869 \$1.60	9782 \$1.60	11822 \$1.35
5/8"	23815 2.45	19002 1.90	8860 1.90	11821 1.60
3/4"	23816 2.85	13870 2.10	7118 2.10	11820 1.80
7/8"		15845 2.40	9504 2.30	
1"	23817 3.60	13871 2.65	7650 2.85	14002 2.20
1 1/4"	10535 4.40	14769 3.65	10575 3.45	14839 2.75
1 1/2"	7119 5.45	13872 4.40	7948 4.50	14003 3.15
2"		17974 5.35		
Approximate Thickness	.007"	.007"	.007"	.007"

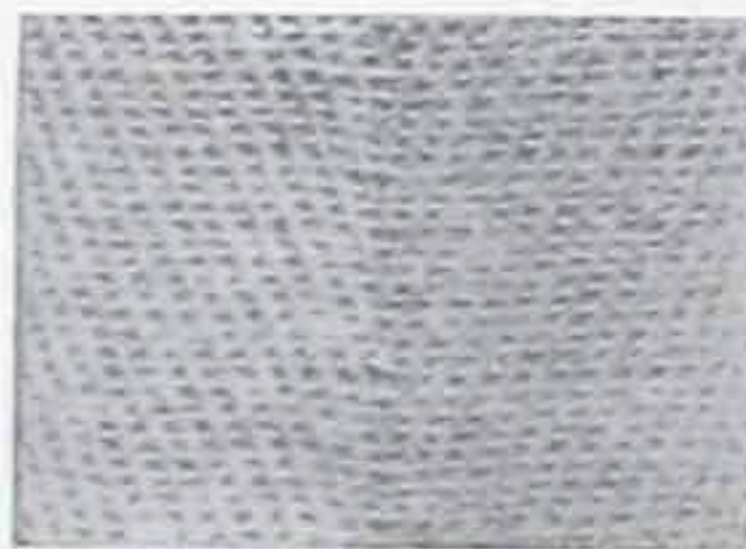
## THIN LINEN FINISHED TAPES

Width	Standard	Special	Silk
1/4"	10470 \$1.52		15841 \$3.15
3/8"	8769 1.50		12821 4.00
7/16"			11216 4.40
1/2"	8841 1.70		16604 4.95
5/8"	8843 1.90		12519 6.00
3/4"	7703 2.20	12018 \$2.00	14734 6.95
7/8"	9298 2.45		
1"	8844 2.65	16061 2.45	16299 8.85
1 1/4"	12359 3.35		
Approximate Thickness	.005"	.005"	.006"

## WEBBINGS

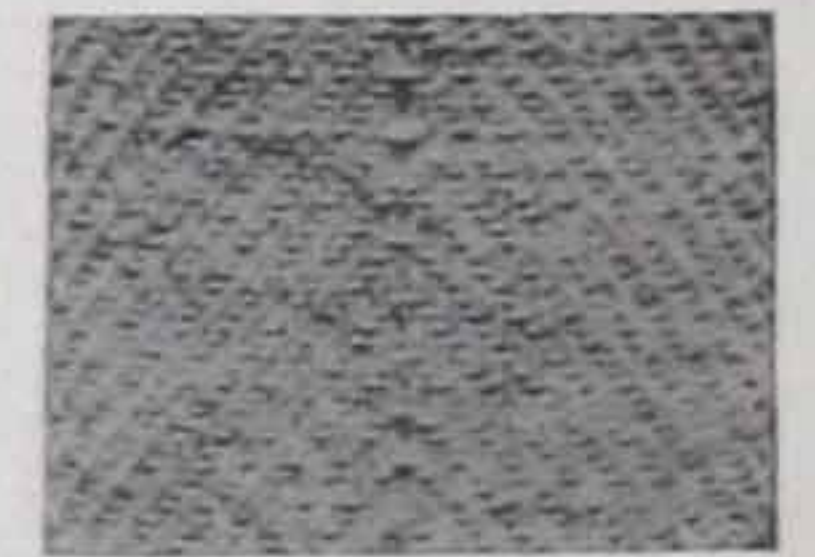


Width	Star	Common	Fine
1/4"		4254 \$1.70	
1/2"	22390 \$1.80	3736 2.75	21790 \$3.15
5/8"	22392 2.10	3890 3.05	21792 3.70
3/4"	22394 2.45	13100 3.60	21794 4.20
1"	22398 2.85	16628 4.50	21798 5.65
Approximate Thickness	.015"	.015"	.015"



Width	Light Stay	Stand. Surgical	Spec. Surgical
1/2"		7699 \$3.15	
3/4"		5281 4.10	19003 \$3.15
1"	6291 \$3.35	5224 5.25	15618 4.00
1 1/4"	6290 4.10	5298 6.30	19004 5.25
1 1/2"	6289 4.85	8870 7.75	18146 6.10
2"	4544 6.85	9058 10.30	18486 8.90
2 1/4"		10449 11.45	19750 9.65
2 1/2"		15859 13.65	16139 11.30
2 3/4"			16130 13.20
3"		15861 16.50	19483 14.10
Approximate Thickness	.013"	.025"	.023"

Width	Standard Non	Special Non
1/2"	4092 \$3.60	
5/8"	4093 4.10	
3/4"	4094 4.75	19005 \$3.80
7/8"	10177 4.85	
1"	3862 5.55	13238 4.40
1 1/4"	4096 6.90	14671 5.75
	3094 7.65	13097 6.50
1 3/4"	4097 9.30	
2"	4098 11.10	19006 9.30
Approximate Thickness	.032"	.027"



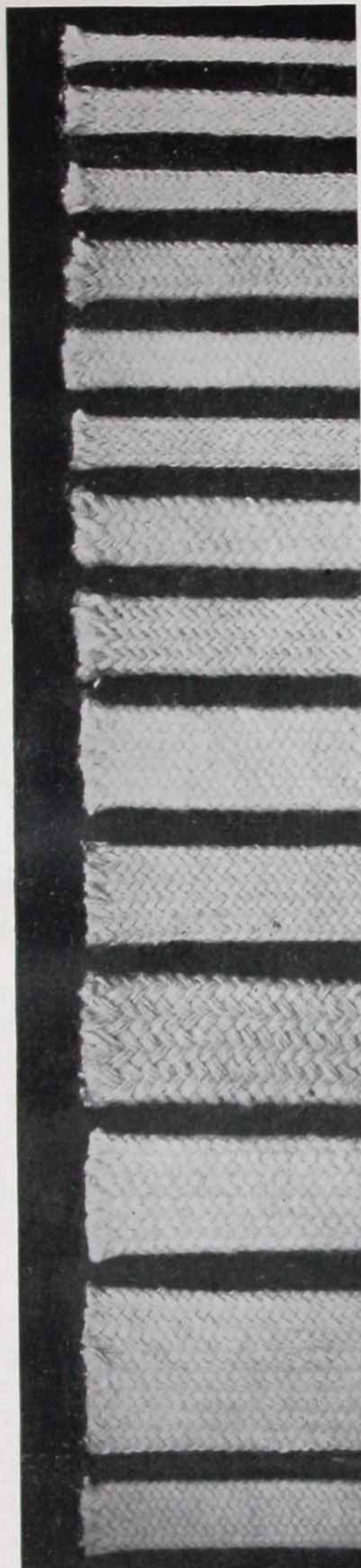
Width	Extra Heavy	Heavy
3/4"	19451 \$4.30	
1"		8730 \$4.50
1 1/4"		9982 5.45
1 1/2"	1258 7.55	1613 6.60
2"		9999 8.70
Approximate Thickness	.027"	.022"



EXACT SIZES

No.

COTTON SLEEVING



0  
.0641  
1  
2  
3  
4  
5  
6  
8  
9  
10  
11  
12  
13

No.	YARDS PER LB.	B. & S. GAUGE BARE WIRE	WHITE	BLACK, RED AND BLUE
0	600	14 to 20	\$2.44 Lb.	\$2.94 Lb.
.0641"	630	14 to 16	2.44 "	2.94 "
1	230	11 to 13	1.82 "	2.32 "
2	180	7 to 9	1.82 "	2.32 "
3	175	9 to 10	1.94 "	2.44 "
4	225	5 to 7	2.10 "	2.60 "
5	100	5	1.80 "	2.30 "
6	110	3 to 4	1.90 "	2.40 "
7	120	3 to 4	1.90 "	2.40 "
8	65	1 to 2	1.80 "	2.30 "
9	105	1 to 2	1.92 "	2.42 "
10	65	1 to 0	1.74 "	2.24 "
11	60	1 to 0	1.80 "	2.30 "
12	50	Two 0 Wires	2.16 "	2.66 "
13	160	6 to 7	2.00 "	2.50 "

BINDERS' CLOTH



Straight      Pebble      Diagonal

Used for covering the outside of magnet coils. Three patterns in black carried in stock, special patterns and colors prepared on short notice.

Standard Rolls, 38"x40 yards.  
(Sold by the roll or linear yard.)

List price, per complete roll . . . . . \$48.00  
" " " yard . . . . . 1.40

or Binding Cloth Tape, see "Slitting," page 49.

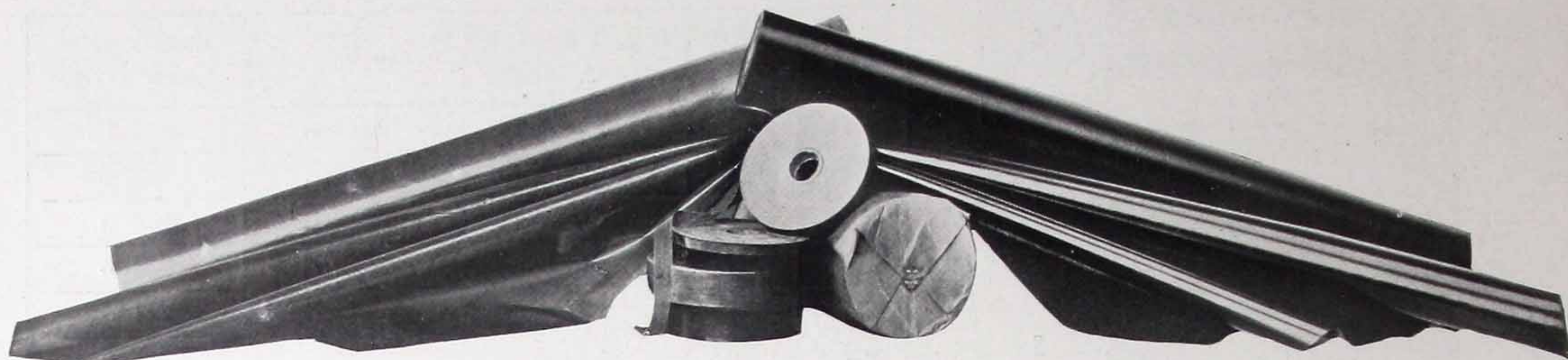
Cotton sleeving is braided, not woven on looms like tape, and is wound on tubes in units of 1, 5 and 10 lbs. in white, black, red, blue and other standard colors.

UNTREATED CLOTHS.

Under this classification we offer plain canvas, duck, drill, muslin, etc. These fabrics are used for car roofs, emergency car repairs, armature hoods, armature binding in connection with twine, and for electrical insulation; they are invariably painted, or treated with an electrical varnish, at point of use. Quotation will be made on sample or specifications.



## VARNISHED MATERIALS



### VARNISHED CAMBRIC

Cambric Cloth when varnished, or "oiled," is variously known as oiled linen, varnished linen, oiled cambric, empire cloth and other trade names.

Although the process of manufacture may differ in a few minor details, the following method is usually employed:

After the cambric is received from the cotton mill, it is bleached and treated by a series of special processes, which not only increase its tensile strength but impart softness, flexibility, and uniformity of thickness. Each operation requires extreme care to avoid injury to the strength and surface of the fabric: the former being a defect not apparent except under actual test.

The varnishing process is also interesting. The material slowly travels through gigantic ovens wherein the varnish is both applied and baked. Here, also, knowledge and care play equally important parts in the production of our varnished products; the specific gravity of the varnish is closely watched as is the baking temperature; the duration of baking never varies—no operation is hurried above the normal and the result is material which is repeatedly found on test to be highest in every essential characteristic.

Yellow Varnished Cambric is treated with a pure, thoroughly oxidized, linseed oil varnish, and it is due to this thorough oxidizing process that our cloth will be found to withstand, without deterioration, all temperature ranges found in properly designed electrical apparatus.

Yellow Varnished Cambric is regularly furnished "dry"; it can also be furnished either tacky or oily if desired.

Black Varnished Cambric, because of the components of the varnish, has greater dielectric strength, higher heat resisting properties and longer life than the yellow; where the greatest ultimate life (electrical endurance) is essential, in combination with both firmness and flexibility, Black Varnished Cambric invariably meets all requirements. It is also oilproof and acid resisting.

Black Varnished Cambric is generally furnished slightly oiled; it may also be had either tacky or dry.

In the data tables which follow, it will be noted that we specify "average puncture voltage." The methods employed to determine dielectric resistance vary greatly, and unless they are specified in connection with the figures given, the figures themselves are meaningless, as, by manipulation of the testing apparatus, practically any values may be secured.

Our Varnished products are rated and guaranteed under the latest A. I. E. E. method, briefly described as follows:

A transformer of 1 K. V. A. capacity is used with a regulated range of from 100 to 30,000 volts; the terminal discs are of 2" diameter, edges rounded on  $\frac{1}{4}$ " radius.

"Puncture Voltage" is obtained by raising the e.m.f. 1,000 volts per minute until break occurs.

"Volts per Mil" are determined by raising voltage 500 volts per second until resistance is overcome.

Figures are computed on averages.



## VARNISHED CAMBRIC

Standard Rolls: 25, 50 or 100 yds. long, 36" wide.

Standard Finish: Dry. Oily or Tacky to Order.

(Sold by the Roll or Linear Yard.)

Thickness	Av. Wgt. per 100-yd. roll	Average Puncture Voltage		List Price, per yd. 50-yd. roll	
		Yellow	Black	Yellow	Black
.004"	25 lbs.	4600- 5400	5000- 6500	\$0.96	\$0.94
.005"	33 "	8000- 9500	8500-11000	.96	.94
.006"	38 "	8000- 9500	9000-12000	.96	.94
.007"	41 "	9500-11500	11500-13000	1.01	.96
.008"	48 "	10000-12000	13000-14500	1.01	.96
.009"	53 "	11000-13000	13500-16000	1.03	1.01
.010"	56 "	12500-14000	17000-19000	1.06	1.01
.012"	68 "	14000-18000	19000-22000	1.32	1.20
.015"	85 "	20000-25000	21000-25500	1.51	1.39

For export packing, add 1/2c per yard, net.

## VARNISHED CAMBRIC TAPES

There are two styles of varnished tape, straight cut and bias cut. For the production of either, full width (36") rolls of varnished cambric, each 72 yards in length, are used.

The straight cut is easier of production, as the tape can be readily "sliced off" into rolls of desired widths.

The preparation of bias tape, however, involves a considerable amount of labor. The yard wide cambric is bias-cut into lengths of a little over 50 inches, the edges butted together and joined on a sewing machine, needle perforations varnished, the cloth re-rolled and the tape then "sliced." It is due to these additional operations that bias tape costs more than straight; but because of its elasticity, which insures a tighter joint and neater wrapping on bends, it is generally preferred to the straight.

After the tape is cut as described each roll is dipped in melted paraffine to hermetically seal it and to prevent its unrolling.

Varnished tape can be furnished in any desired thickness from .004" to .015"; in widths from 3/8" to 36"; bias or straight; yellow or black; and it is almost invariably sold by the pound. Therefore to properly fill an order the following data is essential:

- (1) Number of pounds wanted.
- (2) Color—yellow or black.
- (3) Cut—bias or straight.
- (4) Thickness.
- (5) Width—from 3/8" up.

Thus: 100 lbs. Yellow bias varnished tape .010" x 3/4"

The following table indicates approximate weights of varnished tapes of different thicknesses and widths, based on standard 72 yard rolls; the weight per gross yard being twice that given.



## VARNISHED CAMBRIC TAPE

Approximate Weight per Roll.

Widths	Thicknesses						
	.004"	.005"	.006"	.007"	.008"	.010"	.012"
$\frac{3}{8}$ "	.30 lb.	.32 lb.	.34 lb.	.36 lb.	.41 lb.	.45 lb.	.55 lb.
$\frac{1}{2}$ "	.40 "	.42 "	.45 "	.50 "	.56 "	Yb .60 "	.72 "
$\frac{5}{8}$ "	.50 "	.53 "	.56 "	.62 "	.69 "	BYbs .75 "	.91 "
$\frac{3}{4}$ "	.60 "	.65 "	.68 "	.75 "	.83 "	Yb .90 "	1.10 "
$\frac{7}{8}$ "	.70 "	.75 "	.80 "	.89 "	.95 "	BYbs 1.05 "	1.25 "
1"	.80 "	.85 "	.89 "	1.00 "	1.10 "	Yb 1.20 "	1.35 "
1 $\frac{1}{4}$ "	1.00 "	1.05 "	1.10 "	1.25 "	1.37 "	BYbs 1.50 "	1.80 "
1 $\frac{1}{2}$ "	1.20 "	1.25 "	1.35 "	1.50 "	1.60 "	Yb 1.80 "	2.10 "
1 $\frac{3}{4}$ "	1.40 "	1.45 "	1.55 "	1.75 "	1.95 "	BYbs 2.10 "	2.40 "
2"	1.60 "	1.65 "	1.75 "	2.00 "	2.20 "	2.40 "	2.70 "
3"	2.40 "	2.50 "	2.64 "	3.00 "	3.30 "	BYb 3.50 "	4.05 "

While .010"x $\frac{3}{4}$ " is standard for thickness and width, and is carried in stock in large quantities for immediate delivery, we can also make moderate deliveries of other sizes, indicated in the foregoing table by symbols meaning:

Y—yellow. B—black. b—bias. s—straight.

Items carrying no symbols are made to order, only, in quantities of 25 pounds or over, involving but little delay.

## LIST PRICES

## Varnished Cambric Tape

## BIAS

Width	Thickness			
	.005"	.010"	.012"	.015"
$\frac{3}{4}$ " and over Yellow.....	\$3.28 lb.	2.40 lb.	2.32 lb.	2.08 lb.
" " " Black .....	3.20 "	2.24 "	2.10 "	1.92 "
Under $\frac{3}{4}$ " add 2c list per lb.				

## STRAIGHT

Width	Thickness			
	.005"	.010"	.012"	.015"
$\frac{3}{4}$ " and over Yellow.....	\$3.22 lb.	2.36 lb.	2.26 lb.	2.04 lb.
" " " Black .....	3.14 "	2.18 "	2.06 "	1.88 "

Under  $\frac{3}{4}$ " add 2c list per lb.

Price per Gross Yard: Weight per roll x 2 x Price per lb.





## VARNISHED SILK

Made of the very finest grade of Japanese hand-loom silk, with several coats of the highest grade insulating varnish, thoroughly oxidized, producing an insulation of great tensile and high dielectric strength:

Standard roll 50 yards long, 36" wide.

(Sold by the roll or linear yard.)

Thickness	Weight, per 50-yd. roll (Approx.)	Average Puncture Voltage	List Price, per yd., 50-yd. roll
.002"	9 lbs.	2500- 3500	\$2.12 yd.
.003"	11 "	4500- 5500	2.22 "
.004"	13 "	7200- 8000	2.30 "
.005"	15 "	9000-10000	2.44 "
.006"	18 "	10500-12000	2.60 "
.008"	25 "	14400-16000	2.82 "

Bias cut Varnished Silk may be had in any width desired from 1/2" up, in strips about 51 inches long.

Straight cut Varnished Silk is made in tape 1/2" or wider in continuous strips of 25, 50 or 100 yards. See "Slitting" page 49.

## VARNISHED DUCK

A high grade fabric is used for this purpose, and the finished product is strong, durable, unusually smooth, and runs close to specified thickness. Used for slot insulation, etc.

Standard Rolls 50 yds. long, 30" wide.

(Sold by the roll or linear yard.)

Thickness	Weight, per 100-yd. roll (Approx.)	Average Puncture Voltage		List Price, per yd., 50-yd. roll
		Yellow	Black	
.016"	89 lbs.	14000-16000	24000-30000	\$2.24 yd.

For Varnished Duck tape see "Slitting" page 49.

## VARNISHED CANVAS

Varnished Canvas is not as smooth as Varnished Duck or Varnished Cambric. It is used principally for armature hoods, field coil washers, etc.

Standard Rolls 50 yds. long, 30" wide.

(Sold by the roll or linear yard.)

Thickness	Weight, per 100-yd. roll (Approx.)	Average Puncture Voltage		List Price, per yd., 50-yd. roll
		Yellow	Black	
.030"	144 lbs.	21000-27000	15000-18000	\$1.54 yd.

For Varnished Canvas Tape see "Slitting" page 49.



## VARNISHED PAPERS

Varnish is applied to paper in the same manner and by the same apparatus as that used to coat cambric. We claim that for a given thickness all of our varnished papers will be found to have a heavier film of varnish than those of other makes; indeed, repeated tests show our varnished papers to average 60% varnish, 40% paper, whereas with many others the figures are reversed, averaging 80% paper with only 20% varnish.

The thinner papers are of special value where space is a factor and where the cost of varnished silk is prohibitive. The flexibility of these materials will be appreciated by those who are accustomed to brittle papers; they excel, as well, in tensile strength; strictly high grade products for those who seek the best. Dry finish is standard, but they can also be furnished slightly tacky for winding small coils, etc.

Standard Rolls 50 yds. long, 36" wide.

(Sold by the roll or linear yard.)

Thickness	Style	Average Puncture Voltage	Color	List Price, per yd., 50-yd. roll
.001"	S	1400- 1600	Yellow	\$0.38 yd.
.0015"	G	4000- 5000	"	.38 "
.002"	B	4500- 5000	"	.38 "
.003"	B	5400- 6000	"	.38 "
.03 mm.	G*	2500- 3000	"	.38 "
.04 mm.	G*	4000- 5000	"	.38 "
.04 mm.	B*	4000- 5000	"	.38 "
.05 mm.	B	4 00- 5000	"	.38 "
.07 mm.	B	4950- 5500	"	.38 "
.004"	K	4400- 5000	"	.32 "
.005"	K	5500- 6250	"	.32 "
.005"	B	5500- 6250	"	.40 "
.005"	E*	5500- 6250	"	.32 "
.007"	R*	7700- 8700	Red	.48 "
.007"	K*	7700- 8700	Black and Yellow	.32 "
.010"	K*	12000-15000	" "	.40 "
.015"	K*	16500-18750	" "	.80 "
.020"	K*	22000-25000	" "	.88 "

\*Complete rolls only.

For Varnished Paper Tape see "Slitting" page 49.

## BONDING PAPER

This paper is coated with a cement varnish which when heated becomes strongly adhesive. Used as a separator between windings in armature and magnet coils and baked, it will bond the successive layers of wire and increase the internal insulation.

Standard Rolls: 50 yds. x 36".

Thickness: .0035".

List Price, per yard, \$0.40.

Sold by the roll or linear yard.





## M-R IMPREGNATED VARNISHED TUBE

Heat Resisting, Oil, Water, Gas and Acid Proof.

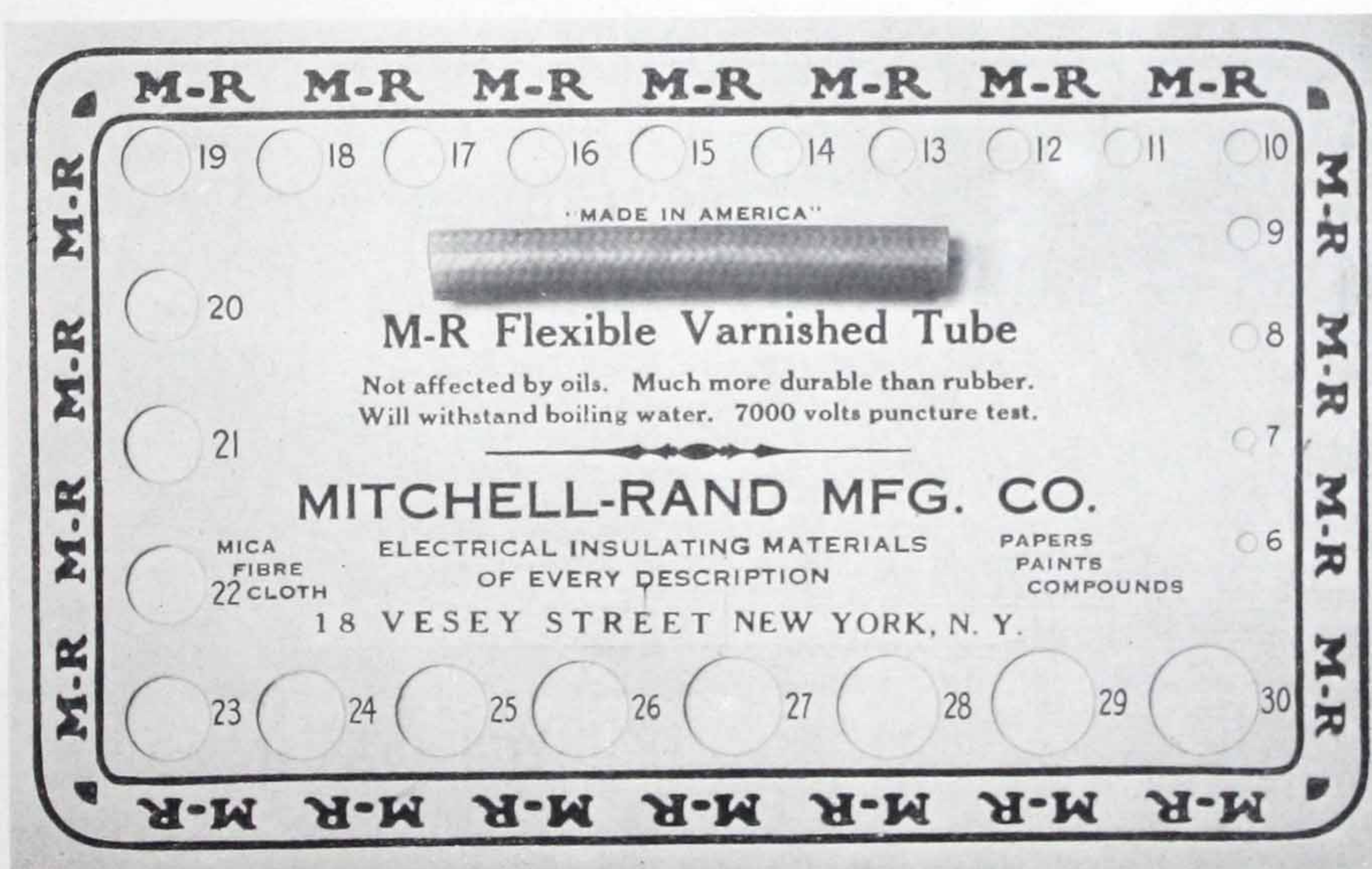
This tubing is made by closely braiding cotton yarn over steel mandrels (of diameter varying with tube bore required), the fabric being thoroughly impregnated with a high quality of insulating varnish and then baked; successive coats of varnish are applied and baked until a wall of the required thickness is obtained. Each coat is carefully "rubbed down" and the surface thus secured is far smoother than that of any tube made by the European or "dip" method; and because of its homogeneous character, or the complete union of the superimposed films of varnish, it is higher in dielectric strength and of greater ultimate life than any tube made by the "short cut" process.

It is quite impossible to guarantee dimensions in anything so elastic and flexible as this tubing. As will be seen in the illustration of the gauge card (one of which will be mailed on application), this tubing is made in sizes from 6 to 33 in the French scale, the interior dimensions being indicated in the subjoined table.

If a stiff, hard wire is to be covered, and a neat fit desired, the size specified will be satisfactory; but if a soft wire is to be insulated, and particularly if the length be greater than two or three inches, the tubing must be of a loose fit or the wire cannot be entered unless the next larger size tube be selected. This caution applies as well to rubber-covered wire, which varies considerably in its own diameter. When in doubt submit a sample of the wire to be used and proper recommendations will be made.

Yellow and black are standard colors; brown, red or special colors will be made to order where quantity is sufficient. Black (as is true with all varnished materials) is a better dielectric and also retains its flexibility, or life, for a much longer period.

No. Tube	To fit over B & S Bare Wire
6	22
7	18-20
8	16-18
9	14-16
10	12-14
11	11-12
12	10-11
14	8-10
16	7
18	5-6
20	5
22	4
24	3
26	2
28	2
30	1



Net Price List per Foot. Standard length: 2 feet.

French Gauge	Up to 99 ft.	100 to 499 ft.	500 to 4999 ft.	5000 ft. and over
Nos. 6 to 10	\$0.11 ft.	\$0.09 ft.	\$0.08 ft.	\$0.07 ft.
Nos. 11 to 14	.12 "	.10 "	.09 "	.08 "
Nos. 15 to 20	.14 "	.12 "	.11 "	.10 "
Nos. 21 to 25	.18 "	.16 "	.14 "	.13 "
Nos. 26 to 30	.20 "	.18 "	.16 "	.15 "
Nos. 31 to 33	.22 "	.20 "	.18 "	.17 "



## VARNISHES AND PAINTS

### READY REFERENCE DATA SHEET

BAKING VARNISHES					Net Trade Prices Per Gallon	
Color	Surface	Bake	Proof	Order as	Character	5-gal. can 1-gal. can
Clear		8-10 hrs.	OAW	Sterling Ex. Ins.	Tough	\$2.20 \$2.25
Clear		12 hrs.	OW	Sterling Ex. Elas.	Elastic	2.20 2.25
Clear		8-10 hrs.	OWH	M-RNo. 1	Elastic	2.70 2.75
Black		6-8 hrs.	WAO	Sterling Quick Baking	Tough	2.10 2.15
Black		12 hrs.	OWAH	Sterling Plastic	Plastic	2.10 2.15
Black		4-5 hrs.	OWA	M-RNo. 2	Hard	1.65 1.70
Black		10 hrs.	AWO	Sterling Elas. Black Bak.	Elastic	1.70 1.75
AIR DRYING VARNISHES						
Clear		1/2 hr.	MA	Sterling Clear A. D.	Tough	2.20 2.25
Clear		1 hr.	OAM	Sterling Copad	Strong	2.20 2.25
Black		1/2 hr.	WA	Sterling Black A. D.	Tough	1.45 1.50
Black		1 hr.	OAM	Sterling Bopad	Strong	2.20 2.2
Black		1-2 hrs.	OWAH*	M-RNo. 15	Flexible	1.37 1.42
FINISHING VARNISHES						
Clear		1-3 hrs.	WOA§	M-RNo. 11	Flexible	2.25 2.30
Black		1-3 hrs.	WOA	M-RNo. 14	Flexible	4.00 4.05
Black		1/2 hr.	WAOH*	Sterling Special Black	Hard	2.65 2.70
CORE PLATE VARNISHES						
Clear	Bake, min.	Dry, 1 hr.	AOWH	M-RNo. 5	Elastic	2.15 2.20
Black		Dry, 1-3 min.	HM†	Sterling Black C. P.	Uniform	1.15 1.20
BLACK PAINTS						
Dry		5 min.	WA	Sterling Black Ins.	Quick	1.20 1.25
Dry		24 hrs.	WAH	M-R G. M.	Ex. Flex.	.80 .85
Dry		12 hrs.	WAH	M-R E. B.	Flexible	.85 .90
Dry		18 hrs.	WAHG	M-RNo. 4	Tough	1.15 1.20
SPAR VARNISH						
Dry		24 hrs.	OAWG	U. S. "Code No. 25"	Woodwork	3.95 4.00

\*Should not be used directly over enameled wire.

§No. 11 can be furnished in any desired color.

†Black Core Plate is not oilproof.

A—acidproof. G—unaffected by gases. H—heat resisting. M—moisture resisting.  
O—oilproof. W—waterproof.

Above prices are net and subject to change without notice.

Special quotations on drums, barrels and half barrels.





The Sterling Varnish Co.  
Products

## VARNISHES AND PAINTS

SHIELD BRAND



Mitchell-Rand Mfg. Co.  
Products

We offer a unique line of varnishes and paints—the products of two manufacturers who have each had nearly thirty years experience in this specific field.

As agents and representatives of The Sterling Varnish Company, our prices on their products are identical with those prevailing at their factory. We carry a full assortment of these varnishes in various size containers ready for immediate shipment in the original packages.

The high quality of Sterling Varnishes is universally recognized, and when offered to the trade in conjunction with our Shield Brand Varnishes, an assortment is presented from which selection may be made for work of any character—whether the desideratum be quality or economy—with the positive knowledge that the material adopted is the best obtainable in its particular class.

As will be observed from the table on the preceding page, the first group embraces the Baking Varnishes, divided into two classes, clear and black. Each class contains varnishes of different degrees of flexibility and elasticity. The most binding and quickest drying are the least elastic, while the more elastic will stand longer exposure to extreme heat conditions without becoming injured.

The second group presents Air Drying Varnishes under the same arrangement. Finishing Varnishes come next in order.

The relative merits of baking varnishes, air drying varnishes and finishing varnishes (or spirit varnishes) are well known. Baking varnishes are, of course, superior as insulators; air drying varnishes come next; whilst finishing varnishes are used not because of their insulating properties (although they must be non-conductors), but to protect the under coat of insulating varnish against moisture, and to provide a smooth, glossy surface which will not become dulled when the apparatus is cleaned of oil and dirt with a benzine-saturated cloth.

A fact of primary importance concerning all insulating varnishes, and one which does not seem to be generally understood, is that their dielectric resistance increases directly with the length of their baking period, or drying period, the "slow" varnishes imparting the highest degree of insulation and flexibility—and it is the tough, flexible film which may be depended upon for mechanical strength and extreme durability under aggravating temperature fluctuations. Slow drying varnishes contain higher percentages of gums and oils which blend or "fuse" as the solvent gradually evaporates; whereas the highly volatile materials used in quick drying varnishes disappear so rapidly that "fusing" is impossible and the invariable result is a granular, crystalline coating which soon becomes a mass of minute moisture-absorbing fissures—or honey-combed.

Black varnishes, whether baking or air drying, should invariably be selected for all work where a transparent coating is not absolutely essential; the black varnishes producing a more flexible and highly insulating film than the clear varnishes of their respective class.



Manufacturers of electrical apparatus have long recognized the fact that high grade varnishes are most economical, inasmuch as breakdowns through failure of insulation must be prevented if their product is to build or maintain a desired or established reputation. In the average repair shop, however, varnish is considered from the viewpoint of price and is completely satisfactory if it dries quickly. Yet the difference in cost between a cheap varnish and a good varnish is, considering the quantity used, a very small matter, but its effect on the shop's reputation is just as important to the proprietor as it was (and is) to the manufacturer.

Notwithstanding all that has been said on the subject, shellac is still used. It is moisture-absorbing, softens under heat and actually defeats the very purpose for which it was intended, that is, as an electrical insulator.

## DESCRIPTIVE

### Clear Baking Varnishes

#### STERLING EXTRA INSULATING VARNISH

(Benzine solvent.)

An amber-colored, clear, baking varnish yielding a transparent coat of maximum dielectric and mechanical strength. Oil, acid and water proof. Embodies the highest binding and cementing qualities obtainable in a varnish together with a firmness of coat, which enables it to withstand heavy mechanical pressure.

This varnish is specially suitable for coils and other windings where conductors must be bound together to guarantee against movement and withstand considerable pressure on their surfaces. Impervious to and insoluble by lubricating and transformer oils, even when they are hot. A large percentage of the electrical apparatus made during the past twenty years has been insulated with it.

Bake: 8 to 10 hours at 100° C. (212° F.) Surfaces can be dried in air in a somewhat longer time.

#### SHIELD BRAND NO. 1

(Benzine solvent.)

For linen, cotton tapes, canvas, paper, fibre, coils, armatures, etc., of high tension apparatus such as magnetos, etc. Penetrating and very elastic; oil, water and heat resisting. A clear insulating varnish of the highest grade.

Bake: 8 to 10 hours at 100° C. (212° F.)

#### STERLING EXTRA ELASTIC INSULATING VARNISH

(Benzine solvent.)

A dark, amber-colored baking varnish, a high dielectric with maximum elasticity and flexibility. Requires long baking—it will not air dry. When baked becomes firm, tough and binding, oil and water proof.

The purpose of this varnish is the insulation of apparatus operating at temperatures and overloads deteriorating and shortening the life of insulating materials.

Bake: 12 hours or more at 100° C. (212° F.)

### Black Baking Varnishes

#### SHIELD BRAND NO. 2.

(Benzine solvent.)

For motor repairs, coils, armature laminations or core plates, transformers, tapes, ignition cables and to increase the insulation of fabrics, etc. Prevents absorption of moisture, and is heat, water, acid and oil resisting. Dense, elastic and glossy.

Bake: 4 hours at 135° C. (275° F.) Or for longer periods at lower temperatures.

#### STERLING BLACK QUICK BAKING VARNISH

(Benzine solvent.)

A black, fast-drying baking varnish with excellent flexibility and toughness combining high insulating and good physical qualities with high working speed. It is heat-enduring, firm, tenacious, water, acid and oil proof. Intended for all insulation where a short baking period is an object; also as a baking japan finish.

Bake: 6 to 8 hours at 100° C. (212° F.)

#### STERLING BLACK PLASTIC INSULATOR.

(Benzine solvent.)

A deep, black colored varnish of maximum and enduring flexibility. The most flexible insulating varnish produced. A very high insulator wet or dry. Will not air dry and requires long baking, but when properly baked becomes firm, binding, oil, water and acid resistant. Does not harden or crack under excessive temperatures.

Drying period: 12 hours or more in a ventilated oven at 100° C. (212° F.)

#### STERLING BLACK BAKING VARNISH

(Benzine solvent.)

This varnish has been specially compounded to meet the requirements of those who require a dependable insulator at low cost. Resists oil, acid and moisture, is extremely flexible and will neither harden nor crack under vibration or temperature changes.

Baking period: 10 hours at 100° C. (212° F.)



## Clear Air Drying Varnishes

### STERLING CLEAR DRYING VARNISH

(Benzine solvent.)

A clear air drying varnish entirely free from electrically conductive solvents, therefore a high dielectric wet or dry. Moisture and acid proof. It has a good body and yields an excellent, uniform, smooth, tough, transparent coat.

Drying period: About one-half hour.

### STERLING COPAD

(Benzine solvent.)

An oil base, benzine solvent varnish. When thoroughly dry it yields a glossy, flexible coat, adhesive, mechanically strong and sufficiently oil, acid and moisture proof to meet the demands of the electrical manufacturer.

Drying period: About one hour.

## Black Air Drying Varnishes

### STERLING BLACK AIR DRYING VARNISH

(Benzine solvent.)

A black varnish entirely free from electrically conductive solvents, therefore a high dielectric wet or dry. Has a good body and with one application yields an excellent deep black coat both uniform and tough.

### STERLING BOPAD

(Benzine solvent.)

Similar to Copad, except in color. Both are designed to replace shellacs and spirit finishing varnishes.

### SHIELD BRAND NO. 15.

(Benzine solvent.)

For coils and general repair work where a quick drying yet high grade varnish is required. Produces a flexible, durable coating which is highly insulating,



oil, water and acid resisting. A "one coat" product. Not suitable for use over enameled wire.

Sets in one-half to one hour, dries in two to four hours.

## Finishing Varnishes

### SHIELD BRAND NO. 14.

(Denatured alcohol solvent.)

For motor frames, coils, laminations and all purposes requiring a quick drying, oilproof insulating varnish. Made from the same formula as No. 11, dyed a permanent black with highest grade aniline.

### STERLING SPECIAL BLACK FINISHING VARNISH

(Denatured alcohol solvent.)

An air drying, spirit finishing varnish, yielding a hard, glossy coat which is water, acid and oilproof. It stands high heat and cannot be marked by the hands. Permanently black.

Drying period: about 30 minutes.

### SHIELD BRAND NO. 11.

(Denatured alcohol solvent.)

For finishing electrical apparatus to prevent absorption of moisture and oil. Produces an insulating coating which is compact, flexible, oil and waterproof—characteristics unusual in a quick drying varnish—and it will be found an excellent substitute for shellac, not only in the electrical industry, but for sizing walls preparatory to painting, etc. Strongly acidproof. May be had in a wide variety of brilliant colors.

Drying period:  $\frac{1}{4}$  to 1 hour, depending upon thickness of coat.



## Core Plate Varnishes

### STERLING BLACK CORE PLATE VARNISH

(Benzine solvent)

A very rapid air drying black varnish, leaving a smooth, uniform coat, which is adhesive and heat enduring; specialized for the insulation of core laminae to prevent eddy currents in armatures, fields, transformers (except oil immersed) and magnet cores generally.

Drying period: 1 to 3 minutes.

### SHIELD BRAND NO. 5

(Benzine solvent)

A clear varnish used for separating and insulating the laminae of high voltage electric machines, air and oil cooled transformers, etc. Produces an elastic, homogeneous, heat conducting coating, which is acid resisting, oil and waterproof.

Air dries in 1 hour; bakes in 5 minutes.

## Black Paints

### STERLING BLACK INSULATING PAINT

(Benzine solvent)

A rapid air drying insulating paint which is flame resisting, water and acid proof. Has good body and yields an excellent, insulating, glossy coat of the highest durability practicable in rapid drying material.

Drying period: about 5 minutes.

### SHIELD BRAND G. M.\*

(Benzine or gasoline solvent)

Used for battery boxes, car trucks and fenders, iron, woodwork, etc. A black insulating and waterproofing paint which resists the action of acids and alkalis; flows freely, covers about 300 square feet per gallon, and dries quickly with a glossy and permanently flexible finish.

Drying period: about 1 day, depending on weather conditions.

### SHIELD BRAND E. B.\*

(Benzine or gasoline solvent.)

Used to prevent decay of wood, or to protect iron and other metals against rust and corrosion; when applied to smokestacks or furnace fronts its heat resisting properties ensure great durability; unaffected by temperature changes and will positively not crack in the coldest weather. A glossy black electrical insulating paint which may also be safely used as a waterproofing compound in construction work of all kinds. Resists acids, alkalis and corrosive gases. This is not an "asphaltum," or coal tar, paint, byproducts of gas plants.

Drying period: about 12 hours.

### SHIELD BRAND NO. 4\*

(Benzine or gasoline solvent)

Used for cable joints, battery boxes, coils, switchboards, trolley poles, motor frames—in fact wherever a heavy, flexible brilliant black coating is required. Possesses unusual mechanical strength; resists acids and alkalis. Extensively used as a waterproofing compound.

Drying period: about 18 hours.



\* Note: In the manufacture of Shield Brand acid and alkali resisting paints no bisulphide of carbon is employed and they are, in consequence, entirely free of the disagreeable odor which characterizes some others. Nor should their waterproofing qualities be overlooked for the preservation of wood or iron in wet or moist places, either above or below ground, or for permanently waterproofing cement structures, etc., they are unreservedly recommended. It must be understood, however, that no other paint can be applied over them and that their use is therefore restricted to locations where an enduring black surface is unobjectionable.



U. S. "CODE NO. 25" (Spar) VARNISH

(Turpentine Solvent)

Were it not for the endorsement of the government (to whom we are indebted for the name of this material), it would scarcely seem possible to combine so many important features in an air drying varnish of great dielectric resistance. Government tests, however, proved "Code No. 25" (Spar) to be:—

- (1) Waterproof, oilproof and acid resisting on wood, fabric or metal;
- (2) Of best grade materials;
- (3) Clear and transparent;
- (4) Sets in 5 hours, dries hard in 24; may be rubbed down after 48 hours;
- (5) Neither flakes nor cracks when bent;
- (6) Unaffected by boiling or cold water;
- (7) Will not turn white.

Used for instrument boxes, metals, interior and exterior woodwork, furniture, floors, boats, canoes, etc. A pale, heavy-bodied, freely flowing varnish which brings out the delicate shades of finely grained woods, dries sufficiently hard in 24 hours to be handled or walked upon, and resists the action of alkalis, acids, gas and oils; is strictly waterproof and will not turn white when exposed to rain or salt water, or even if immersed in boiling water.

It is apparent that as an "all around" varnish "Code No. 25" (Spar) is unique. It can be safely used for any purpose whatsoever—from furnishing a protective coating for the most delicate apparatus to finishing a pullman car. Nor is its use confined to the shop. As a furniture varnish it is without comparison, and it may be dull rubbed or polished to a piano finish; as a wear-resisting floor varnish it is unexcelled; for outside work it stands all weathers and temperatures; for motor boats it adequately meets every requirement, being absolutely waterproof.

"Code No. 25" (Spar) varnish may be washed with soap and water; is extremely elastic and will not chip or crack under a blow sufficiently hard to dent the wood beneath it.

"Code No. 25" (Spar) varnish was so named by U. S. Government after it had "satisfactorily passed all tests made upon it, including the gas and exposure tests."

There is no better varnish made. "Code No. 25" (Spar) represents the highest development in an art centuries old.

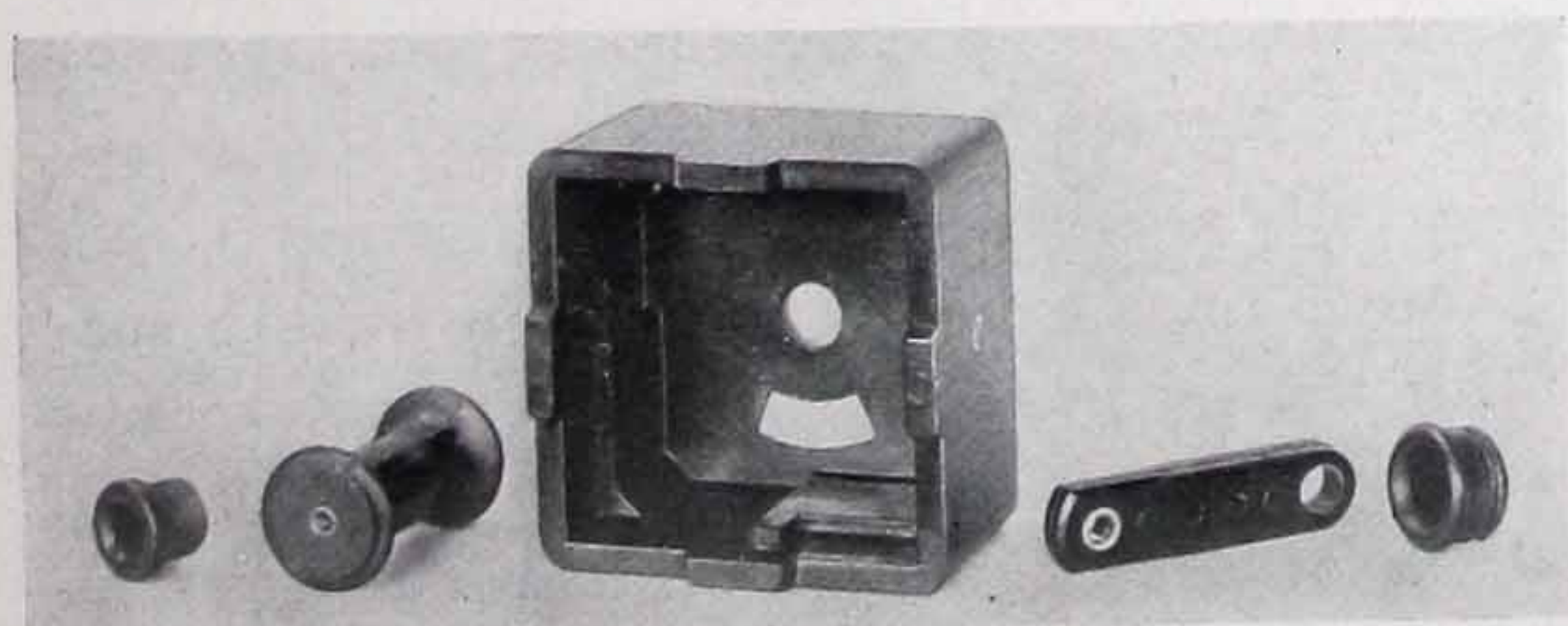
## SHELLAC.

Certain trees of India produce a rosin which a particular species of insect collects and converts into a gum, in which it lays its eggs and is itself often found imbedded. This gum is collected, melted and poured over cooled porcelain cylinders, from which it flakes off in the familiar form of orange gum shellac; when bleached it is known as white shellac.

When gum shellac is cut in alcohol it is known as liquid shellac or shellac varnish. And in this form it is frequently (indeed, almost invariably) adulterated with rosin. Our shellac varnish is based on the U. S. Government formula: 5 pounds pure orange shellac with 1 gallon grain alcohol and 5% methylated spirits. Guaranteed free of rosin and of a grade far superior to the average.

Fine Orange Gum Shellac . . . . .	\$2.88 lb. list
Orange Shellac Varnish . . . . .	12.60 gal. list
White Shellac Varnish . . . . .	13.10 gal. list

Shellac substitutes: Shield Brand No. 11 Varnish (clear) and Shield Brand No. 14 Varnish (black). Cheaper and produce a tougher, elastic and less brittle coating. See description, page 17.

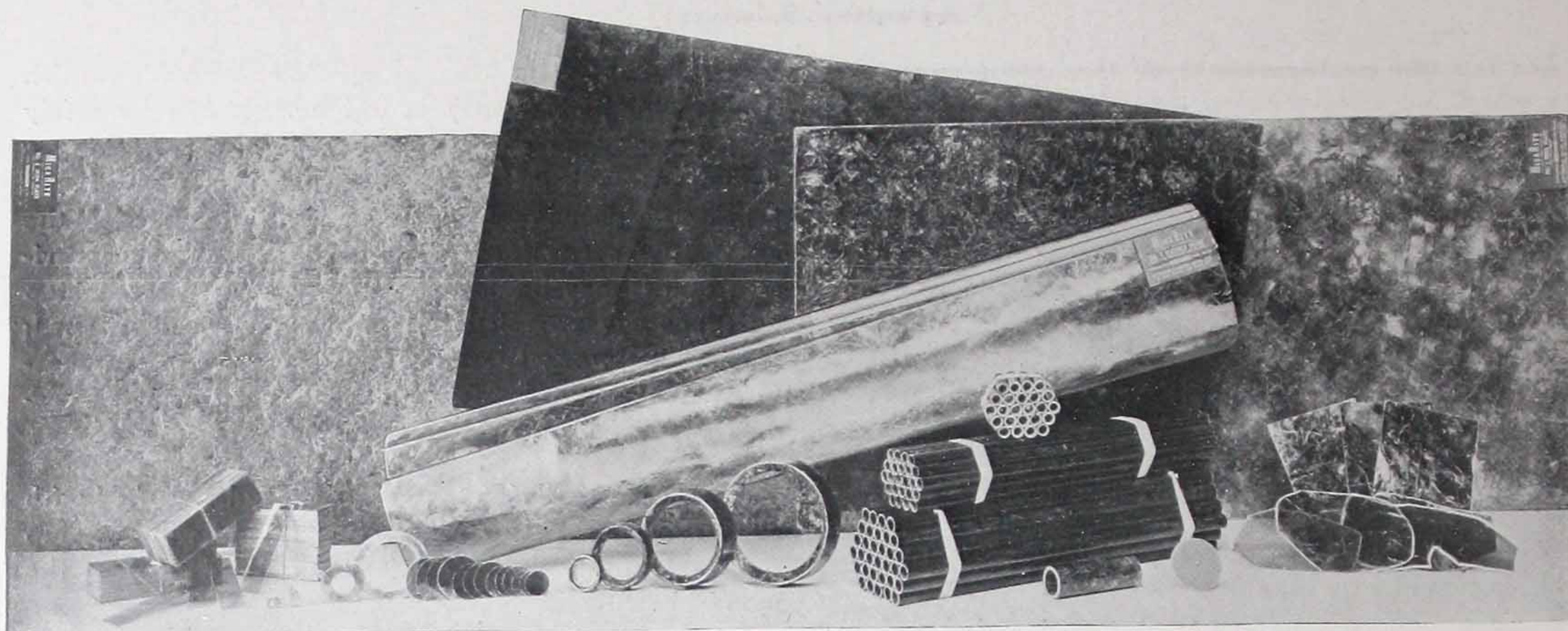


## MOULDED INSULATION

We can furnish moulded pieces of condensite or shellac composition. Prices will be furnished upon receipt of specifications and drawing or sample.



# MICA



## SOLID, OR NATURAL MICA

Analyses of the various grades of Mica show slightly differing chemical compositions, depending upon their source. Silicate of aluminum, potassium and water constitute clear mica. In the "Amber" mica is also found silicate of magnesium. In the grades not suited for high potentials iron is also present, imparting a dark brown color, running to black.

It is the consensus of opinion that mica holds the pre-eminent position as an insulator. There are various grades, each adapted to certain applications and unexcelled for insulation.

"Spotted Electrical," (domestic) which may be even deeply colored, is, because of its lower cost, now commonly used for nearly all electrical purposes, for which it is as good as perfectly clear mica, the discoloration being caused by vegetable spores only and in no way impairs the insulation. All banding mica and washers are produced from "Spotted Electrical" unless clear is specified, which takes a much higher price and is no better for the purpose.

"Metallic Stained" contains iron and other metals, generally found as oxides, but still unsafe. We do not handle this material.

For commutator segments Canadian, or "Amber" should be used. This grade being of about the same hardness as the copper bars, with which it wears down evenly.

For condenser and phonograph work either clear India or Ruby India can be used, carefully selected and split to approximate thickness.

## MANUFACTURED MICA

"MicaRite" is the copyrighted trade name under which all our manufactured mica products are sold.

Because of the cost of solid mica in large sizes, or rather because of the demand for sizes larger than nature has provided, manufactured sheet mica, composed of extremely thin layers of pure mica, with a suitable binder of cement, has become a manufacturing necessity.

There are four classes of mica plate, which are fully described on the following pages. In the production of these plates only India and Amber mica is used, insuring a quality surpassing that in which domestic mica is introduced for the purpose of reducing cost of manufacture, but at the expense of dielectric strength and economy in usage.

Mica tubes and the various other mica products—cloths and papers with which mica is combined—are too well known to require description further than that given. In their manu-



facture quality is of the first consideration, and each product listed represents the best of its class to be found anywhere.

It is impossible to hold mica cloths and papers to any definite finished thickness; where several edges of mica overlap the product is unavoidably thicker than where only one or two layers of mica are found. These materials cannot be milled, or surfaced, like mica plate, and where thickness is given it is intended to be liberally interpreted as the average dimension.

See "Punchings," page 49.

## NO. 1 INDIA "MICARITE" PLATE

(For Moulding)

Known also as "Govt. Grade A." This plate is composed of thin sheets of selected India mica, built up with a minimum of pure orange shellac and carefully milled to thickness. When heated it may be readily formed to any desired shape, which will be permanently retained upon cooling.

Used for conical and band rings, troughs, etc. The thinner sheets can be rolled into tubes. Should not be used as insulation between commutator segments.

Standard Sheets, 18"x36".

Thickness	Pounds, per Sheet (Approx.)	Average Puncture Voltage	List Price, per Pound
.010"	.503	9500	\$2.64
.015"—1/64"	.748	14300	2.64
.020"	.946	19000	2.64
.025"	1.21	23800	2.40
.030"	1.53	28600	2.40
.032"—1/32"	1.64	29700	2.40
.035"	1.68	33300	2.40
.040"	2.17	38100	2.40
.045"	2.25	42900	2.40
.047"—3/64"	2.42	44600	2.40
.050"	2.64	47700	2.40
.055"	2.92	51600	2.40
.060"	3.19	55600	2.40
.063"—1/16"	3.32	59600	2.40
.06 "	3.44	66500	2.40
.070"	3.7	76400	2.40
.095"—3/32"	4.92	89300	2.40
.125"—1/8"	6.22	119200	2.40

## NO. 11 INDIA "MICARITE" PLATE

(For Moulding)

Similar to the No. 1 Plate, with the exception that it is unmilled, and for all ordinary purposes where exact thickness is not an essential will be found as satisfactory. Size, weight, etc., same as No. 1.

.020" thick and under	\$2.40 per lb.
.025" " " over	2.16 "



## NO. 2 "MICARITE" PLATE

(For Commutator Segments)

"Govt. Grade B" composed of India Mica films, bonded with a special cement and milled to exact thickness. It will neither ooze when heated nor shrink with age. Absolutely dependable. Cannot be moulded.

Standard Sheets, 18"x36".

Thickness	Pounds, per Sheet (Approx.)	Average Puncture Voltage	List Price, per Pound
.010"	.567	9 50	\$2.64
.015"—1/64"	.85	14300	2.64
.020"	1.13	19000	2.64
.025"	1.41	23800	2.40
.030"	1.70	28600	2.40
.032"—1/32"	1.76	29800	2.40
.035"	1.98	33400	2.40
.040"	2.27	38200	2.40
.045"	2.55	42900	2.40
.047"—3/64"	2.65	44600	2.40
.0 0"	2.83	47700	2.40
.055"	3.1	51700	2.40
.060"	3.4	57300	2.40
.063"—1/16"	3.54	59600	2.40
.065"	4.2	62500	2.40
.070"	4.8	78400	2.40
.095"—3/32"	5.3	89400	2.40
.125"	7.05	119300	2.40

## NO. 22 "MICARITE" PLATE

(For Commutator Segments)

Similar to the No. 2 Plate, except that it is unmilled. It is an ideal plate for all flat work where slight variation is allowable. Size, weight, etc., same as No. 2.

.020" thick and under	\$2.40 per lb.
.025" " " over	2.16 "

DISCOUNT SHEETS, BASED ON THE  
LIST PRICES HEREIN, ARE ISSUED  
MONTHLY. IS YOUR NAME ON OUR MAIL-  
ING LIST?



## NO. 5 AMBER "MICARITE" PLATE

(For Commutator Segments)

Manufactured expressly for Commutators containing a large number of bars, or where bars and brushes are softer than those usually employed. Made from selected soft Canadian Amber Mica. Cannot be moulded.

Standard Sheets, 18"x36"

Thickness	Pounds, per Sheet (Approx.)	Average Puncture Voltage	List Price, per Pound
.010"	.567	8000	\$4.08
.015"	.85	12000	4.08
.020"	1.13	16600	4.08
.025"	1.41	20700	3.84
.030"	1.70	24900	3.84
.032"—1/2"	1.76	25800	3.84
.035"	1.98	29000	3.84
.040"	2.27	33200	3.84
.045"	2.55	37300	3.84
.047"—3/64"	2.65	38800	3.84
.050"	2.83	41500	3.84
.055"	3.11	45600	3.84
.060"	3.4	49800	3.84
.063"—1/16"	3.54	51800	3.84
.065"	3.68	60100	3.84
.070"	3.96	78000	3.84

## NO. 55 AMBER "MICARITE" PLATE

(For Commutator Segments)

Similar to No. 5, except that it is unmilled. May be used under the same conditions. Size, weight, etc., same as No. 5.

.020" thick and under	\$3.78 per lb.
.025" " " over	3.54 " "

WHAT IS YOUR PROBLEM? WE HAVE HAD OVER THIRTY YEARS EXPERIENCE IN THIS AND ALLIED LINES AND MAY BE ABLE TO HELP YOU—AS WE HAVE HELPED OTHERS.



## NO. 7 FLEXIBLE "MICARITE" PLATE

(For Armature Slots, Etc.)

This plate is composed of India Mica films and a permanently flexible cement of dependable adhesiveness, permitting the completed plate to be bent or formed without the application of heat.

Standard Sheets, 36"x36".

Thickness	Pounds, per Sheet (Approx.)	Average Puncture Voltage	List Price, per Pound
.005"	.575	2900	\$2.16
.010"	.967	800	1.92
.015"	1.43	8200	1.92
.020"	1.84	11700	1.92
.025"	2.24	14700	1.92
.030"	2.64	17600	1.92
.032"—1/32"	3.04	18300	1.92
.063"—1/16"	6.03	36700	1.92
.125"—1/8"	12.	73500	1.92

## NO. 9 FLEXIBLE "MICARITE" PAPER

Composed of 1, 2 or 3 layers of India Mica between two layers of Japanese tissue paper. Extensively used in transformer and armature winding.

Standard Sheets, 32"x36".

Standard Rolls, 32"x16'.

Approx. Thickness	Layers of Mica	Pounds, per Roll (Approx.)	List Price, per Pound
.006"	1	2.1	\$2.28
.009"	2	3.3	2.18
.011"	3	4.5	2.00

## NO. 10 "MICARITE" CLOTH

Composed of cotton cloth, carrying 1, 2 or 3 layers of India Mica film, faced with a layer of thin Japanese paper. Frequently used in conjunction with Varnished Cambric, Fish Paper, etc., for transformers, field coils, armature slots, etc.

Standard Sheets, 30"x30".

Standard Rolls, 16'x30".

Approx. Thickness	Layers of Mica	Pounds, per Roll (Approx.)	List Price, per Pound
.012"	1	3.	\$2.21
.015"	2	4.2	2.06
.018"	3	6.	1.95



## NO. 12 "MICARITE" ROPE PAPER

A combination of rope paper, two layers of Mica and a tissue paper facing; having a wide range of uses where low temperatures and moderate voltages prevail. Used extensively for armature and transformer insulation.

Standard Sheets, 36"x36".

Thickness, Paper Only	Finished Thickness (Approx.)	Weight, per Sheet (Approx.)	List Price, per Pound
.003"	.007"	7.5	\$2.35
.005"	.010"	12.	1.75
.010"	.015"	15.	1.40

## NO. 13 "MICARITE" TAPE

MicaRite paper, consisting of one layer of Mica between two of tissue paper, can also be furnished in tape form for insulating armature coils, etc., in conjunction with friction tape or varnished cambric tape.

Standard Rolls, 64 Linear Feet.  
Standard Thickness, Approx. .007".

Width	Weight, per Roll (Approx.)	List Price, per Pound
3/4"	4 1/2 oz.	\$2.88 lb.
1"	6 "	2.88 "
1 1/4"	7 1/2 "	2.88 "
2"	12 "	2.88 "

## NO. 14 "MICARITE" FISH PAPER

Similar to MicaRite Rope Paper, except that Fish Paper forms the base, making a much stronger material.

Standard Sheets, 36"x47".

Thickness, Paper Only	Finished Thickness (Approx.)	Weight, per Sheet (Approx.)	List Price, per Pound
.005"	.010"	1.2	\$3.20
.007"	.012"	1.4	3.00
.010"	.01 "	1.6	2.80
.015"	.020"	2.	2.60

## NO. 15 "MICARITE" PRESSBOARD

A high grade of No. 1 Pressboard faced with India Mica films and Japanese tissue, slightly stronger and more rigid than MicaRite Rope Paper, but not as strong as MicaRite Fish Paper.

Standard Sheets, 36"x36".

Thickness Pdb. Only	Finished Thickness (Approx.)	Layers of Mica	Weight, per Sheet (Approx.)	List Price, per Pound
.007"	.012"	2	.9	\$1.60
.012"	.017"	2	1.2	1.30
.015"	.020"	2	1.5	1.20



## "MICARITE" TUBING

There are three grades of MicaRite Tubing, the price of which depends not on a difference in quality of material but on the cost of manufacture, production being facilitated by the increased percentage of paper used. There is a slight variation in their properties, however, the greatest amount of mica giving best results where potentials and temperatures run high.

### ROUND "MICARITE" TUBING

Standard Lengths: 1 ft. to 3 ft.

List Price per Foot.

50% Mica.

Thickness of Wall	3/16" to 1/2 O.D.	9/16" to 13/16 O.D.	14/16" to 1" O.D.
1/32"	.18	.22	.24
1/16"	.20	.24	.26
3/32"	.22	.26	.28
1/8"	.24	.28	.30

75% Mica.

1/32"	.20	.24	.26
1/16"	.22	.26	.28
3/32"	.24	.28	.30
1/8"	.26	.30	.32

All Mica.\*

1/32"	.30	.38	.42
1/16"	.34	.42	.46
3/32"	.38	.46	.50
1/8"	.42	.50	.54

\*"All Mica" tubing is provided with a thin outer layer of Japanese paper to prevent flaking caused by abrasion.

We can furnish MicaRite tubing square, oval, of special shape, or in larger sizes than above indicated.

We make rings, bands, sleeves, segments, etc., either from samples or drawings. Specifications for estimate solicited.

## PLAS MICA

Plas-Mica is a soluble form of mica and contains ingredients similar to natural mica. The mineral goes through a long process to separate its several components, which are again united when the powder and accompanying liquid are combined, whereupon it sets to about the same degree of hardness as natural mica compressed between the bars of a commutator.

Properly mixed and applied, it will adhere to the mica left between the bars and will not fly out or chip when the commutator is running.

Plas-Mica sets without shrinking; it does not "dry" like other commutator compounds, but hardens because of the chemical combination of the liquid and powder.

Plas-Mica will resist oil, acid and water. It may be brought to a welding heat in a crucible without undergoing any material change in structure. Natural mica would calcine or disintegrate under the same temperature.

It can be applied in a few minutes and, if necessary, the machine run in from fifteen minutes to half an hour.

Plas-Mica will keep indefinitely. Will not corrode copper or other metals. A 1/4 ounce set will make from 15 to 30 ordinary repairs. Full directions accompany each outfit.

List Prices

1/4-ounce bottle of liquid and powder, per set	\$ 3.00
Additional bottles of liquid or powder, each	1.50
1/4-pound bottle of liquid or powder, each	6.00
1/2-pound bottle of liquid or powder, each	12.00
1-pound bottle of liquid or powder, each	24.00



CUT INDIA AND DOMESTIC ELECTRICAL MICA

Size	List Price per Pound	Size	List Price per Pound	Size	List Price per Pound	Size	List Price per Pound	Size	List Price per Pound	Size	List Price per Pound
1 x 3	\$3.00	1½x 7	\$11.00	2¼x 4	\$ 7.00	2¾x 6½	\$12.75	3½x 3½	\$10.75	4½x10	\$24.00
1 x 4	4.50	1½x 8	12.75	2¼x 4½	9.00	2¾x 7	13.50	3½x 4	11.25	5 x 5	15.00
1 x 4½	6.50	1½x 9	14.50	2¼x 5	10.00	2¾x 8	14.50	3½x4½	11.75	5 x 6	16.00
1 x 5	8.00	1½x 10	16.50	2¼x 5½	10.50	2¾x 9	16.50	3½x 5	12.25	5 x 7	17.00
1 x 5½	9.00	1¾x 4	6.50	2¼x 6	12.00	2¾x10	19.00	3½x 5½	13.00	5 x 8	18.00
1 x 6	9.50	1¾x 4½	7.50	2¼x 6½	12.50	3 x 3	9.00	3½x 6	14.00	5 x 9	21.00
1 x 6½	9.75	1¾x 5	9.50	2¼x 7	13.00	3 x 3½	10.00	3½x 6½	14.50	5 x10	25.00
1 x 7	10.00	1¾x 5½	10.25	2¼x 8	13.75	3 x 4	10.75	3½x 7	15.00	5½x 6	16.50
1 x 8	12.00	1¾x 6	10.75	2¼x 9	15.75	3 x 4½	11.00	3½x 8	16.00	5½x 7	17.50
1 x 9	13.00	1¾x 6½	11.00	2¼x10	18.25	3 x 5	12.00	3½x 9	18.00	5½x 8	18.50
1 x10	15.00	1¾x 7	11.50	2½x 3	6.75	3 x 5½	12.25	3½x10	22.00	5½x 9	22.00
1¼x 4	5.50	1¾x 8	13.00	2½x 3½	7.00	3 x 6	12.50	4 x 4	11.50	5½x10	26.00
1¼x 4½	6.75	1¾x 9	15.00	2½x 4	7.50	3 x 6½	13.00	4 x 4½	12.00	5½x11	27.00
1¼x 5	8.50	1¾x 10	17.00	2½x 4½	9.00	3 x 7	14.00	4 x 5	12.50	5½x12	30.00
1¼x 5½	9.50	2 x 2	4.00	2½x 5	10.25	3 x 8	15.00	4 x 5½	13.50	6 x 6	17.50
1¼x 6	10.00	2 x 3	6.00	2½x 5½	11.00	3 x 9	17.00	4 x 6	15.00	6 x 7	20.00
1¼x 6½	10.25	2 x 3½	6.25	2½x 6	12.25	3 x10	20.00	4 x 6½	15.50	6 x 8	24.00
1¼x 7	10.50	2 x 4	6.75	2½x 6½	12.75	3¼x 3¼	9.75	4 x 7	16.00	6 x 9	25.00
1¼x 8		x 4½	8.75	2½x 7	13.25	3¼x 3½	10.25	4 x 8	17.00	6 x10	30.00
1¼x 9	14.00	2 x 5	9.75	2¼x 8	14.00	3¼x 4	11.00	4 x 9	19.00	7 x 7	25.00
1¼x10	16.00	2 x 5½	10.50	2½x 9	16.00	3¼x 4½	11.50	4 x10	23.00	7 x 8	27.00
1½x 2	3.00	2 x 6	11.75	2½x10	18.75	3¼x 5	12.25	4½x 4½	12.50	7 x 9	28.00
1½x 3	4.50	2 x 6½	12.50	2¾x 3	7.00	3¼x 5½	12.50	4½x 5	13.50	7 x10	32.00
1½x 4	6.25	2 x 7	13.00	2¾x 3½	7.50	3¼x 6	13.00	4½x 5½	14.50	8 x 8	32.00
1½x 4½	7.00	2 x 8	13.50	2¾x 4	9.00	3¼x 6½	13.75	4½x 6	16.00	8 x 9	33.00
1½x 5	9.00	2 x 9	15.50	2¾x 4½	9.75	3¼x 7	14.50	4½x 6½	16.50	8 x10	35.00
1½x 5½	10.00	2 x10	18.00	2¾x 5	10.50	3¼x 8	15.50	4½x 7	17.00		
1½x 6	10.50	2¼x 3	6.50	2¾x 5½	11.50	3¼x 9	17.50	4½x 8	17.50		
1½x 6½	10.75	2¼x 3½	6.75	2¾x 6	12.25	3¼x10	21.00	4½x 9	20.00		

WE ISSUE AT REGULAR INTERVALS  
INTERESTING TRADE LITERATURE, IM-  
PORTANT ANNOUNCEMENTS CONCERN-  
ING NEW MATERIALS OR IMPROVED  
METHODS, DISCOUNT SHEETS, ETC.  
IS YOUR NAME ON OUR MAILING LIST?



## INDIA UNCUT SHEET MICA

## AMBER UNCUT SHEET MICA

Grade	Will cut assorted sizes	Price per Pound	Grade	Will cut assorted sizes	Price per Pound
A 1	4 inches to 6 inches wide and 7 inches to 9 inches long	\$12.00	A 1	4 inches to 5 inches wide and 7 inches to 9 inches long	\$7.00
1	3 inches to 5 inches wide and 5 inches to 7 inches long	10.00	1	3 inches to 6 inches wide and 5 inches to 7 inches long	5.00
2	1½ inches to 3½ inches wide and 4½ inches to 6 inches long	8.00	2	1½ inches to 3½ inches wide and 4½ inches to 6 inches long	3.50
3	1½ inches to 3 inches wide and 3 inches to 4½ inches long	6.00	3	1½ inches to 3 inches wide and 3 inches to 4 inches long	3.00
4	1½ inches to 2½ inches wide and 2½ inches to 3 inches long	3.60	4	1½ inches to 2½ inches wide and 2½ inches to 3 inches long	2.00
5	1 inch to 2 inches wide and 2 inches to 2½ inches long	2.00	5	1½ inches to 2 inches wide and 2 inches to 2½ inches long	1.00

## MICA WASHERS AND DISCS

Outside Diameter, Inches	LIST PRICE PER POUND																			
	INSIDE DIAMETER INCHES																			
	1⅝	1½	1¼	1⅓	1	¾	⅝	⅜	⅜	⅜	⅜	⅜	⅜	⅜	⅜	⅜	⅜	⅜	⅜	Discs
3	\$ 3.25	\$ 3.25	\$ 3.25	\$ 3.00	\$ 2.75	\$ 2.50	\$ 2.50	\$ 2.50	\$ 2.50	\$ 2.50	\$ 2.50	\$ 2.50	\$ 2.50	\$ 2.50	\$ 2.50	\$ 2.25	\$ 2.25	\$ 2.25	\$ 2.25	\$ 2.25
2⅞	3.25	3.25	3.25	3.00	2.75	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.25	2.25	2.25	2.25	2.25
2¾	3.00	3.00	3.00	2.75	2.50	2.40	2.40	2.40	2.40	2.40	2.40	2.40	2.30	2.30	2.25	2.25	2.25	2.15	2.15	2.15
2½	2.75	2.75	2.75	2.50	2.25	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.10	2.10	2.10	2.10	2.00	2.00	2.00	2.00
2⅜	2.50	2.50	2.50	2.25	2.25	2.00	2.00	1.90	1.90	1.90	1.85	1.85	1.85	1.85	1.80	1.80	1.80	1.80	1.80	1.80
2¼	2.25	2.25	2.25	2.00	2.00	1.90	1.90	1.90	1.90	1.85	1.85	1.75	1.75	1.75	1.75	1.75	1.75	1.70	1.70	1.70
2⅓	2.25	2.25	1.90	1.90	1.90	1.80	1.80	1.80	1.75	1.75	1.75	1.65	1.65	1.65	1.65	1.60	1.60	1.60	1.60	1.60
2	2.25	2.25	1.90	1.90	1.90	1.75	1.75	1.65	1.65	1.65	1.65	1.60	1.60	1.60	1.60	1.50	1.50	1.50	1.50	1.50
1⅞	2.25	2.25	2.15	1.95	1.90	1.80	1.75	1.70	1.65	1.65	1.65	1.60	1.50	1.50	1.50	1.50	1.40	1.40	1.40	1.40
1¾	2.25	2.25	2.25	2.00	1.90	1.80	1.75	1.70	1.65	1.65	1.60	1.60	1.50	1.50	1.50	1.40	1.40	1.40	1.40	1.40
1⅝	2.35	2.10	2.00	1.80	1.75	1.70	1.65	1.65	1.60	1.60	1.50	1.45	1.45	1.45	1.45	1.40	1.40	1.40	1.40	1.40
1⅜	2.50	2.25	2.20	1.90	1.85	1.75	1.65	1.65	1.50	1.50	1.45	1.45	1.45	1.45	1.45	1.40	1.40	1.40	1.40	1.40
1⅓	2.25	2.25	2.15	2.10	2.00	1.80	1.75	1.60	1.55	1.50	1.45	1.45	1.45	1.45	1.45	1.40	1.40	1.40	1.40	1.40
1½	2.30	2.30	2.25	2.20	2.15	2.00	1.90	1.80	1.70	1.60	1.50	1.50	1.50	1.50	1.50	1.50	1.40	1.40	1.40	1.40
1⅞	2.40	2.40	2.30	2.25	2.20	2.15	2.00	1.95	1.90	1.85	1.80	1.70	1.60	1.50	1.50	1.50	1.45	1.45	1.45	1.45
1¾	2.50	2.50	2.30	2.25	2.25	2.25	2.15	2.05	1.90	1.70	1.60	1.50	1.50	1.50	1.50	1.45	1.45	1.45	1.45	1.45
1⅝	2.35	2.35	2.25	2.25	2.25	2.25	2.15	2.00	1.80	1.65	1.60	1.55	1.45	1.40	1.40	1.35	1.35	1.35	1.35	1.35
1⅜	2.50	2.50	2.35	2.35	2.25	2.25	2.25	2.15	2.00	1.80	1.65	1.60	1.50	1.40	1.30	1.25	1.25	1.25	1.25	1.25
1⅓	2.75	2.65	2.45	2.30	2.25	2.15	2.00	1.90	1.80	1.70	1.60	1.50	1.40	1.30	1.20	1.15	1.15	1.15	1.15	1.15
1½	2.75	2.75	2.50	2.35	2.25	2.15	2.00	1.90	1.80	1.70	1.60	1.50	1.40	1.30	1.20	1.15	1.15	1.15	1.15	1.15
1⅞	3.00	2.90	2.65	2.40	2.30	2.20	2.15	2.00	1.90	1.80	1.70	1.60	1.50	1.40	1.30	1.25	1.25	1.25	1.25	1.25
1¾	2.75	2.45	2.35	2.25	2.15	2.00	1.90	1.80	1.70	1.60	1.50	1.40	1.30	1.20	1.15	1.15	1.15	1.15	1.15	1.15
1⅝	3.00	2.50	2.35	2.25	2.20	2.00	1.90	1.80	1.70	1.60	1.50	1.40	1.30	1.20	1.15	1.15	1.15	1.15	1.15	1.15
1⅓	2.75	2.50	2.25	2.25	2.05	1.95	1.90	1.80	1.70	1.60	1.50	1.40	1.30	1.20	1.15	1.15	1.15	1.15	1.15	1.15
1½	2.50	2.50	2.25	2.10	2.00	1.90	1.90	1.90	1.90	1.90	1.90	1.90	1.90	1.90	1.90	1.90	1.90	1.90	1.90	1.90
1⅞	3.00	2.75	2.25	2.15	2.15	2.00	1.90	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75
1¾	2.50	2.25	2.25	2.10	2.00	1.90	1.90	1.90	1.90	1.90	1.90	1.90	1.90	1.90	1.90	1.90	1.90	1.90	1.90	1.90
1⅝	3.25	2.75	2.50	2.25	2.25	2.15	2.05	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.95
1⅓	4.25	4.00	3.75	3.50	3.25	3.00	2.75	2.50	2.25	2.00	1.75	1.50	1.25	1.00	0.75	0.50	0.25	0.25	0.25	0.25
1½	4.75	4.50	3.75	3.50	3.25	3.00	2.75	2.50	2.25	2.00	1.75	1.50	1.25	1.00	0.75	0.50	0.25	0.25	0.25	0.25
1⅞	5.00	4.25	3.25	3.25	3.25	3.25	3.25	3.25	3.25	3.25	3.25	3.25	3.25	3.25	3.25	3.25	3.25	3.25	3.25	3.25
1¾	5.25	4.00	3.25	3.25	3.25	3.25	3.25	3.25	3.25	3.25	3.25	3.25	3.25	3.25	3.25	3.25	3.25	3.25	3.25	3.25
1⅝	6.50	5.00	3.25	3.25	3.25	3.25	3.25	3.25	3.25	3.25	3.25	3.25	3.25	3.25	3.25	3.25	3.25	3.25	3.25	3.25

These prices are for Mica Washers of random thickness, as the Mica runs. We can furnish Mica Washers built up to any exact thickness. Prices on receipt of specifications.



## SHIELD BRAND SOLDERING PASTE

It is doubtful that any soldering paste is made with greater care than Shield Brand. Certainly none can be more painstakingly compounded. Recognizing the fact that our successes are due solely to having exercised unremitting vigilance in the manufacture of our many products, and jealous of the reputation thus achieved, we may be depended upon to produce materials only of absolute uniformity.



The rapid "flow" of the solder and the clean, smooth, strong union of all metals (except aluminum) are features which at once proclaim it the ideal flux. Due to its high concentration, less is required and it is, in consequence, by far the most economical.

Non-corrosive—and absolutely so—this paste may be safely used on the finest work with full confidence that it contains nothing which will cause sulphatation. Shield Soldering Paste contains no acid.

The formula used is the result of careful research in conjunction with extensive tests conducted under actual shop conditions. Shield Brand Soldering Paste is made under direct laboratory supervision, where the standard of all materials is first determined before they are approved for use. The latest improved machines (of the same high grade as are used in the preparation of pharmaceutical creams) insure a mixture wherein all the components are thoroughly blended, and the smallest particle of the paste contains chemicals in the same percentages as are to be found in the mass itself—absolute uniformity throughout.

In connection with the use of Shield Brand Soldering Paste, a "dip" solution of sal ammoniac, muriate of zinc, or other acids for brightening the soldering iron, cannot be too strongly condemned; such acids are certain to affect the work, resulting in corrosion and ultimate disintegration.

Shield Brand Soldering Salts, in the proportion by weight of one part salts to fifty parts water, preferably distilled, is absolutely safe (inasmuch as the active materials are identical in both the salts and paste) and the use of this solution as a "dip" for the soldering iron is strongly recommended.

### SHIELD BRAND SOLDERING PASTE

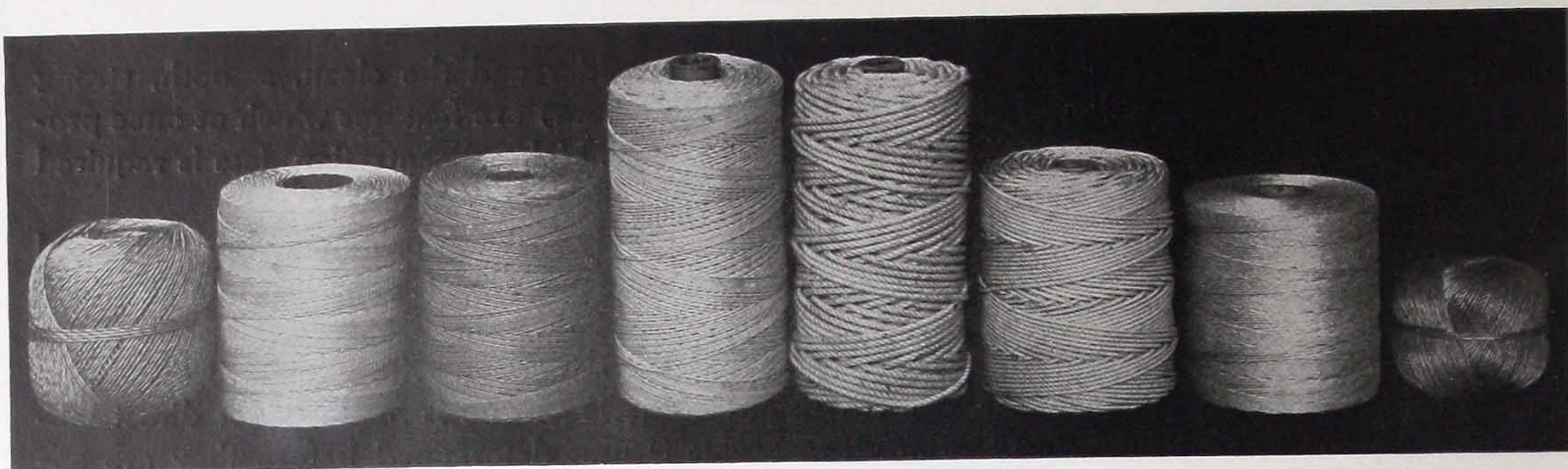
2-oz. Tins—Packed in cartons of 3 doz.		1/2-lb. Tins.	
	List Price		List Price
3 doz. to 1 gross.....	\$1.20 doz.	1 lb. to 25 lbs.....	\$0.50 lb.
1 gross .....	13.50 gross	25 lbs. to 100 lbs.....	.45 "
2 " .....	13.00 "	100 " " 200 " .....	.44 "
4 " .....	11.50 "	200 " " 300 " .....	.42 "
8 " and over.....	10.00 "	300 " and over.....	.40 "
4-oz. Tins—Packed in cartons of 3 doz.		1-lb. Tins.	
	List Price		List Price
3 doz. to 1 gross.....	\$1.60 doz.	1 lb. to 25 lbs.....	\$0.46 lb.
1 gross .....	17.50 gross	25 lbs. to 100 lbs.....	.48 "
2 " .....	17.00 "	100 " " 200 " .....	.46 "
4 " .....	16.00 "	200 " " 300 " .....	.40 "
8 " and over.....	15.00 "	300 " and over.....	.36 "

### SHIELD SOLDERING SALTS

	List Price
1 lb. to 25 lbs.....	\$0.54 lb.
25 lbs. to 100 lbs.....	.48 "
100 " " 200 " .....	.46 "
200 " and over.....	.40 "



## SHIELD BRAND--ARMATURE TWINES



The quality of twine is determined only by its tensile strength. A thin twine of good quality has the strength of a heavier twine of cheaper grade.

There are many so-called linen twines on the market which are merely mercerized cotton, and there are twines said to be "part linen, part cotton," when, as a matter of fact, the two fibres cannot be thus combined.

Shield Brand Twines are exactly as described, either of pure linen of selected quality, of long staple Sea Island or domestic cotton, or of a flax made from plants similar to those producing the genuine linen fibre. In each instance the material used is the best of its respective class, selected with special reference to tensile strength.

In the manufacture of Shield Brand Armature Twine every operation is carefully watched by artisans who have had years of training both in Europe and America, and it is due to their skill that we can guarantee a definite standard of quality heretofore deemed impossible.

Linen twines are understood to be the strongest, but in their manufacture great care must be taken to remove every vestige of the natural oil of the plant, otherwise disintegration begins before the twine is actually made, and its strength continually diminishes. This process of cleaning, or decortication, is made complete in Shield Brand Twines, insuring a degree of reliability attained by but few manufacturers. Flax is considered next in strength, American hemp producing a twine almost equal to linen. Next comes Sea Island cotton, then domestic cotton.

The tensile strength of Shield Brand Armature Twine, of which there are two kinds, cabled and twisted, made in various grades, the description of which follows, is claimed to be greater than any other make of armature twine.



## CABLED CORDS

### CABLED HARD FLAX.

(Sizes, 12 to 48)— $\frac{1}{2}$ -lb. balls.

List Price

A hard twisted twine, made of selected Italian Flax, dressed and highly polished. Compares with Hard Linen in strength. . . . . \$6.70 lb.  
 "Imitation C. H. F." will be found almost as satisfactory as the genuine for ordinary purposes. . . . . 3.60 "

### CABLED WATERPROOF.

(Sizes, 12 to 48)—1-lb. tubes.

Sometimes called Torpedo, Toreador.

A hard twisted cotton, cable laid, lightly waterproofed and polished twine. Absorbs varnish readily; dependably strong; increasingly popular. . . . . 2.50 "

### CABLED COATED.

(Sizes, 12 to 48)—1-lb. tubes.

An exact duplicate of the foregoing except that it is white. . . . . 2.50 "

### CABLED COTTON.

(Sizes, 6 to 72)—1-lb. tubes.

Known also as Cable Cord, Seine Twine, Cotton Cable Laid.

A medium soft white cotton twine, of uniform thickness, without any dressing or "filler." Strong and economical. . . . . 2.10 "

## TWISTED TWINES

### SPECIAL FLAX.

(One size only—10 ply)— $\frac{1}{2}$ -lb. balls.

Commonly known as Mattress Twine, Elm Flax, Polished Kentucky.

A highly polished twisted twine, used for many purposes . . . . . 1.90 "

### BLACK SPECIAL.

(One size only—10 ply)—1-lb. tubes.

A long staple Sea Island cotton, soft twisted twine of non-fading black, possessing remarkable strength. Made in three grades, the best almost equal to average linen.

Black Special A. . . . .	4.50 "
" " B. . . . .	5.00 "
" " C. . . . .	5.50 "

### LINEN SPECIAL.

(3 ply to 50 ply)—1-lb. tubes.

Also called Inseam, Lacing, Linene, Satin Finish.

A Sea Island cotton twine, closely resembling Hard Linen in appearance, and recommended for even the most important service. It will be found a satisfactory linen substitute for all purposes, as the average work never requires the great tensile strength of pure linen, yet does demand more than ordinary cotton possesses. . . . . 3.00 "

### SOFT LINEN.

(3 ply to 12 ply)—1-lb. tubes.

Known as Stitching Twine, 3 to 6 ply, and Boot Thread when over 6 ply.

Made of Pure Irish Linen. No better grade is possible . . . . . 8.00 "

### HARD LINEN.

(3 ply to 12 ply)—1-lb. tubes.

Known as Shoe Stitching 3 to 6 ply, and Inseam over 6 ply.

Made of the highest grade of Pure Irish Linen; hard twisted and polished. Strongest twine made . . . . . 8.00 "

### DARK LINEN.

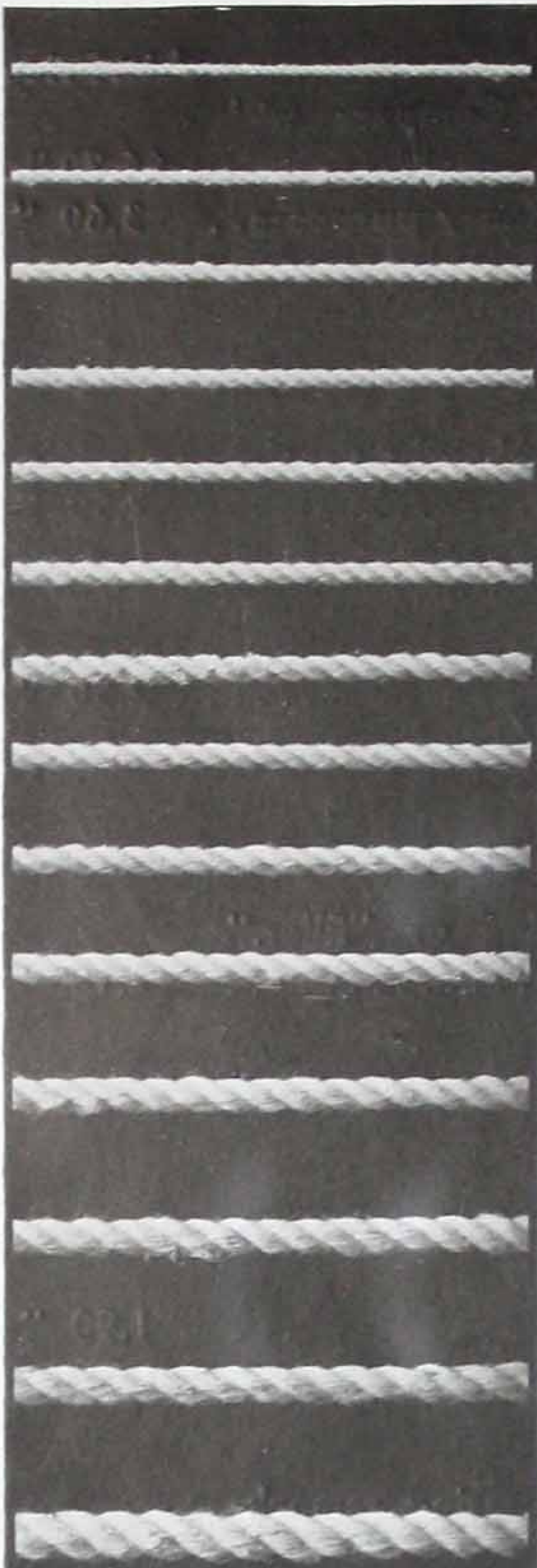
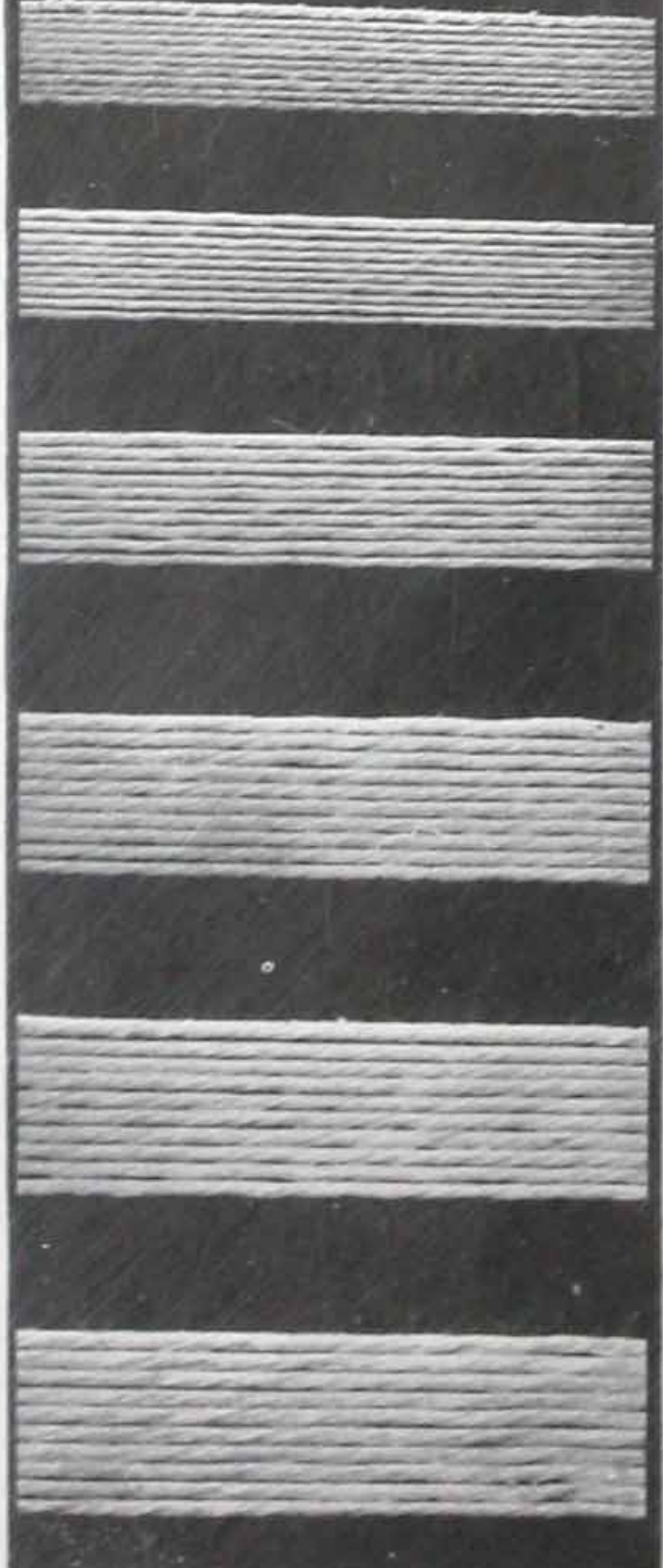
(Waxed, 3 ply to 12 ply)—1-lb. tubes.

Made especially for cable lacing, in two grades, Pure Linen and Linen Special the latter being invariably found fully as satisfactory as linen—and considerably cheaper.

Dark Linen . . . . .	7.00 "
Waxed Linen Special. . . . .	4.00 "



## ARMATURE TWINES CABLED CORDS.

	No.	Approx. Diameter	Approx. Feet, per Pound
	6	.032"—(1/32")	3000
	9	.038"	2000
	12	.047"—(3/64")	1500
	15	.052"	1200
	18	.057"	1000
	21	.063"—(1/16")	900
	24	.071"	800
	27	.074"	650
	30	.076"	600
	36	.080"	500
	42	.095"—(3/32")	450
	48	.120"—(1/8")	400
	60	.130"	350
	72	.140"	300
	TWISTED TWINES.		
	Ply 3	.017"	6700
	4	.020"	5000
	6	.025"	4000
	8	.028"	2300
	10	.040"	1900
	12	.045"	1500

Additional samples on application. Do not remove from sheet.

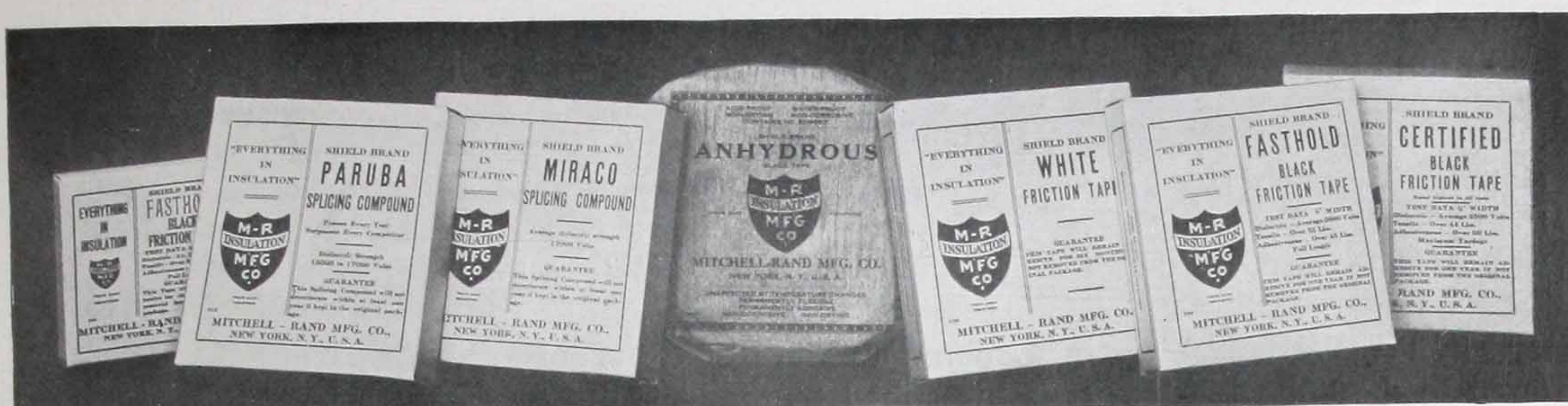
	
Shield Brand	Armature Twines
MITCHELL-RAND MFG. CO.	
18 VESEY ST.	NEW YORK, N. Y.
"EVERYTHING IN INSULATION"	
CABLED HARD FLAX	Sample No. 18
Nos. 12, 18, 24, 36, 48. Furnished in 1 lb. balls.	
CABLED WATERPROOF	Sample No. 24
Nos. 12, 18, 24, 36, 48. Furnished in 1 lb. tubes.	
CABLED COATED	Sample No. 36
Nos. 12, 18, 24, 36, 48. Furnished in 1 lb. tubes.	
CABLED COTTON	Sample No. 48
Nos. 6, 9, 12, 15, 18, 21, 24, 27, 30, 36, 42, 48, 60, 72. Furnished in 1 lb. balls.	
SPECIAL FLAX	This size only
Furnished in 1/2 lb. balls.	
BLACK SPECIAL	This size only
Furnished in 1 lb. tubes.	
LINEN SPECIAL	Sample 4 Ply
Ply—3, 4, 6, 8, 10, 12, 14, 16, 20, 25, 30, 40, 50. Furnished in 1 lb. tubes.	
SOFT LINEN	Sample 6 Ply
Ply—3, 4, 6, 8, 10, 12. Furnished in 1 lb. tubes.	
HARD LINEN	Sample 10 Ply
Ply—3, 4, 6, 8, 10, 12. Furnished in 1 lb. tubes.	
DARK LINEN	Sample 12 Ply
Ply—3, 4, 6, 8, 10, 12. Furnished in 1 lb. tubes.	

Form 236

Send for  
one of these  
sample  
cards.



## SHIELD BRAND FRICTION TAPES



Considerable misapprehension exists as to the correct methods of determining the quality of friction tape. Generally it is slowly unrolled and if it spins out into "long teeth" it is presumed to be good—the longer the teeth the better it is thought to be.

Now, it is actually a fact that this deduction is all wrong. Indeed, it is really only the inferior grades that behave in this manner; they are coated with a "sticky" compound consisting of naphtha and coal tar, or similar substances, selected expressly to produce the deceptive effect described; they contain little or absolutely no rubber—their very odor betrays this fact. The naphtha or other volatile quickly evaporates and soon nothing is left save the dried out coal tar, which is neither an insulator nor waterproof.

The fabric used in such tapes is weak; it breaks and is wasteful; both fabric and compound are heavy, and as friction tape is sold by weight it is apparent that the ultimate cost of supposedly cheap tapes is actually high.

The process by which tape is manufactured is simple. The cloth is either passed through the compound and the surplus removed by rollers, or the compound is applied by rapidly rotating brushes—these being the so-called "Japanese" or "European" methods.

SHIELD BRAND Black Friction Tapes are "dry" and depend solely upon their rubber content for adhesiveness; when unrolled they present a multitude of fine teeth like "set" rubber cement; they contain little that can evaporate, hence their adhesiveness will remain long after "dipped" or "brushed" tapes have dried out. Contrast the careful process employed in the manufacture of Shield Brand Tapes with that of "sticky" tapes, which are hurriedly wrapped in tinfoil to prevent evaporation and thus preserve their "sticky" character.

SHIELD BRAND Black Friction Tapes are double coated. The fabric used is a long staple unbleached cotton sheeting, known as 56/60, (56 warp and 60 filler threads to the square inch), insuring maximum strength. This sheeting is first passed over a series of drying drums so all moisture is expelled; immediately the first, or "filler" coat is applied, thoroughly impregnating the fabric with a permanent insulating, waterproofing and preserving compound, after which it is set aside several days to "dry." The second coat, containing a high percentage of rubber, is then forced through the fabric by three enormous steel rollers; the upper roller, weighing ten tons, moves in the same direction as the cloth, but slightly faster. It is interesting to note that by varying the speed of this upper roller, or in other words increasing the friction, the thickness of the compound applied can be gauged within .001 inch. It was from this process that the material took the name of "Friction" Tape, a term at once adopted by other manufacturers, both of the "dip" and "brush" varieties, and in connection with either of which it is, of course, a misnomer.



Again the material is allowed to stand for several days, after which measured lengths are wound upon paper cores and then cut into the familiar  $\frac{3}{4}$ " wide rolls, wrapped in tinfoil and put in cartons, each weighing one-half pound. While  $\frac{3}{4}$ "— $\frac{1}{2}$  lb. is standard, tape can be furnished (where a quantity is ordered) in any width from  $\frac{1}{2}$ " upward, and in cartons weighing 2 ozs. and over, or the equivalent in millimeters and grams.

The question naturally arises—do the results achieved justify the use of such high grade material, the elaborate process, and painstaking care employed in the manufacture of Shield Brand Friction Tapes? This is answered by the fact that they are the only tapes offered for sale with definite technical data and guarantee printed on each carton.

SHIELD BRAND Black Friction Tapes are of two grades, both of which are manufactured to meet the exacting tests prescribed by the United States Government covering tensile strength, dielectric strength, adhesiveness, non-fraying requirements, heat-resisting qualities and durability.

Following is a list of Shield Brand Friction Tapes and Splicing Compounds, with information thereon which should be of particular interest to those desiring the best that the market can offer:

#### FASTHOLD

##### Black Friction Tape

##### Test Data $\frac{3}{4}$ "

Dielectric Strength:	Average 2000 volts
Tensile Strength:	Over 35 lbs.
Adhesiveness:	Over 45 lbs.
Feet per Pound	Approx. 120

The popular grade, adapted to general work. Excels in quality any tape sold at equal price.

#### WHITE FRICTION TAPE

This material is coated on both sides, is absolutely white and will be found unexcelled for inside work. It is made after the same process as SHIELD BRAND Black Friction Tapes, the rubber used being first bleached. Guaranteed for six months.

Feet per Pound: Approx. 140— $\frac{3}{4}$ " width.

#### CERTIFIED

##### Black Friction Tape

##### Test Data $\frac{3}{4}$ "

Dielectric Strength:	Average 2500 volts
Tensile Strength:	Over 44 lbs.
Adhesiveness:	Over 50 lbs.
Feet per Pound:	Approx. 160

The higher grade. Exceeds U. S. Government specifications. No other tape, at any price, is better.

Guarantee: Fasthold and Certified tapes will remain adhesive for one year if not removed from the original package.

#### WHITE ARMATURE TAPE

Frictioned on one side only, the other side being perfectly dry, this tape is extensively used for repairing coils, automobile wiring, reinsulating old wire, etc. Guaranteed for six months.

Feet per Pound: Approx. 240— $\frac{3}{4}$ " width.

#### SPLICING COMPOUNDS

SHIELD BRAND Splicing Compounds are made in two grades, both of the "semi-cured" type; they produce a highly insulating, homogeneous, and waterproof covering, indefinitely maintained under all atmospheric conditions.

#### MIRACO BLACK SPLICE

Average Dielectric Strength: 12,000 volts.

This compound will be found very satisfactory under all conditions of service. It is of high dielectric strength and of more than average elasticity. Guaranteed for one year.

#### PARUBA GRAY SPLICE

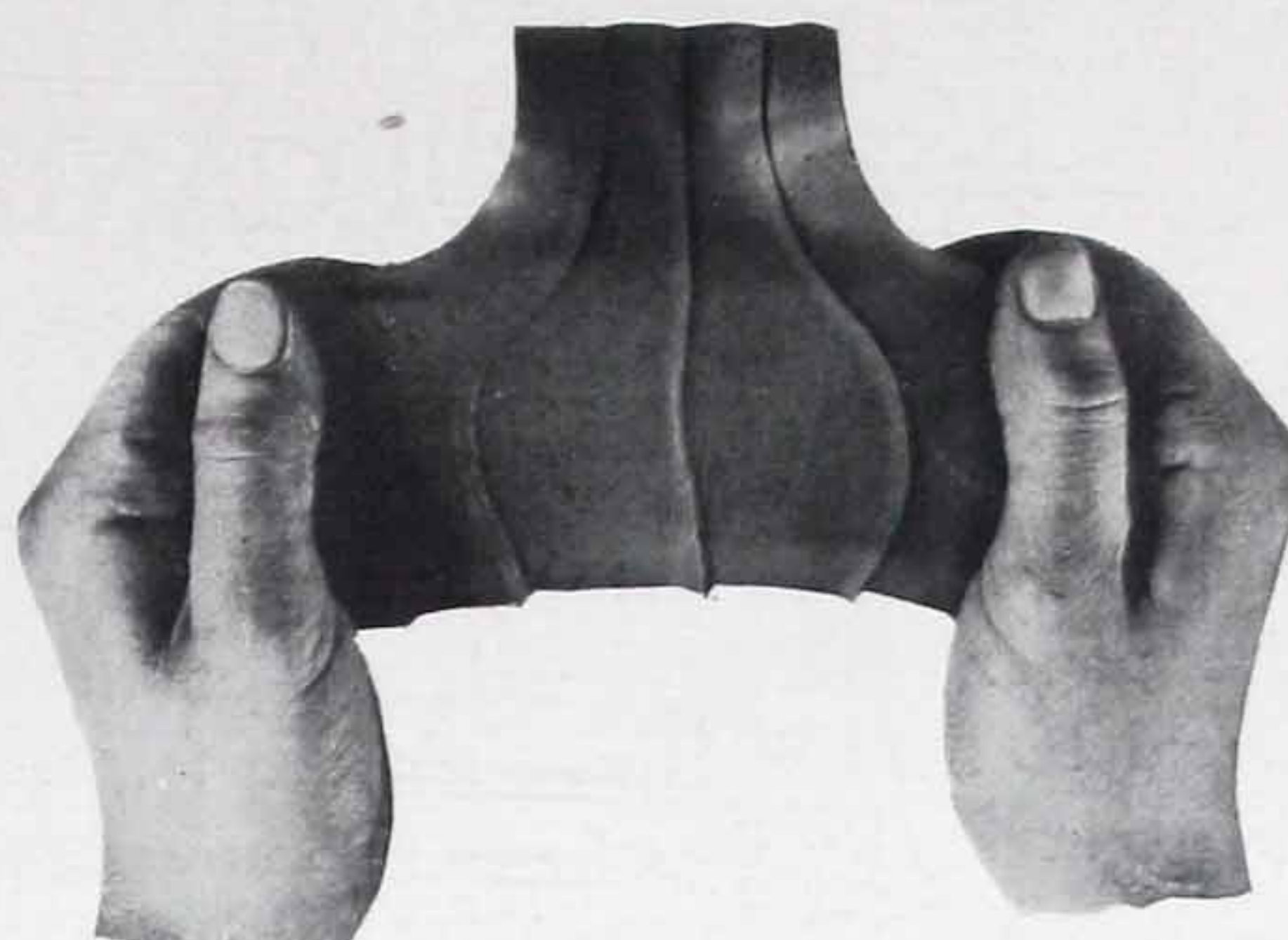
Average Dielectric Strength: 15,000 to 17,000 volts.

No higher grade of splicing compound can be made. The base is pure Para rubber. Paruba excels any splice made in toughness and elasticity, in fact, it even exceeds the exacting U. S. Government specifications, whereas other makes barely meet them. Guaranteed indefinitely in any climate.



### ANHYDROUS TAPE

This tape may be stored for years without deterioration. In service its adhesiveness increases with age. Permanently flexible, non-corrosive, unaffected by temperature extremes and atmospheric conditions; contains no rubber and will not vulcanize or dry out. Coated with a black plastic compound, which is water, acid and alkali proof. Used extensively for cable work in mines and wet places, where perfect insulation is essential, and where constant friction, or dragging over the ground, or around sharp corners, requires maximum wearing qualities.



TESTING "SPLICE"

## HOW TO TEST TAPE AND "SPLICE"

The following are simple methods for testing the adhesiveness, and the tensile strength, of Shield Brand Black Friction Tapes in comparison with other tapes.

### TO TEST FOR ADHESIVENESS

Take a two-foot length of each kind, mark them for identification, cut each in half and rejoin by one-inch laps. Now join the two sets with a one-inch lap, forming one continuous ribbon; all laps should be exactly one inch and equally manipulated to insure uniform contact. As "strength of the chain is equal to the strength of its weakest link," the joint in the less adhesive tape will separate when the test strip is pulled at each end.

Generous samples of FASTHOLD and CERTIFIED will be furnished on request for test as above in comparison—the FASTHOLD with any tape selling at equal price, and the CERTIFIED with any tape selling at a higher price.

### TO TEST FOR TENSILE STRENGTH

Repeat the foregoing, using longer pieces and making the laps four or five inches.

Note: In every instance the face of one strip should be affixed to the back of the one adjacent.

Any number of samples may be joined and all tested at the one time.

Splicing Compound may be tested along similar lines:

Strips should be cut in three-inch lengths, and lapped one-eighth inch lengthwise, instead of being joined end to end; the outer pieces should be grasped firmly along the entire edge and the test sheet stretched.

Note: As in the test of Friction Tape, strips should be joined face to back and the laps evenly worked together.

Samples of Miraco and Paruba will also be forwarded to anyone desiring to test these materials. It is claimed that Miraco is better than any other splice at the same price, and Paruba will be found fully equal to any splicing compound manufactured, regardless of price.

### Prices on Application

THE ADVANTAGE IN BEING ABLE TO  
SECURE "EVERYTHING IN INSULATION"  
FROM ONE SOURCE IS EVIDENT. WHEN  
LOCAL MARKETS FAIL TO YIELD THE  
DESIRED MATERIAL, TRY US.

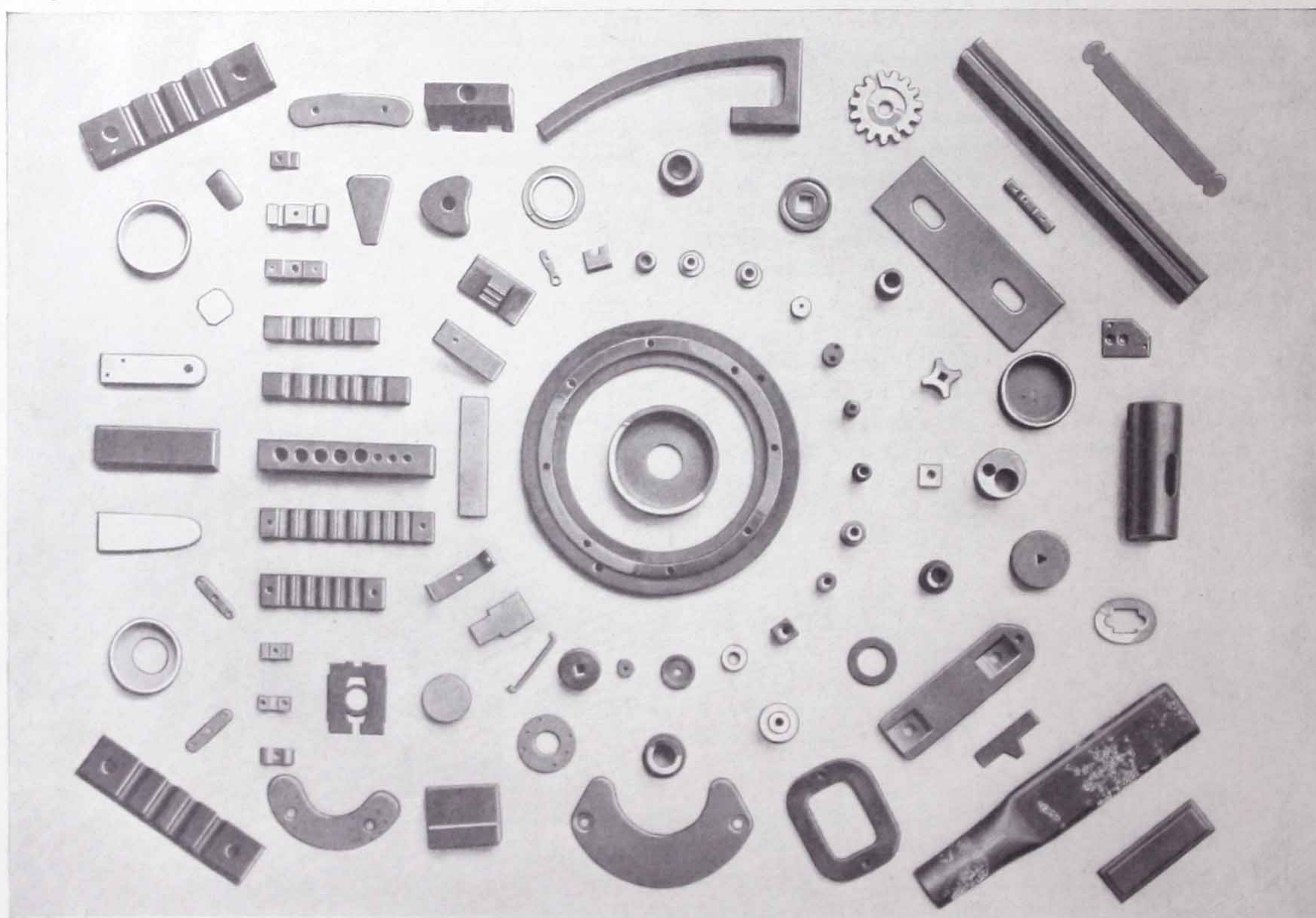
SERVICE — QUALITY — PRICE



## VULCANIZED FIBRE

Vulcanized Fibre is manufactured from cotton rag stock. After cutting the stock into small pieces, it is boiled with soda, washed, bleached, beaten to a pulp, colored red or black (or left in its natural gray state), and run off on paper machines which convert it into a high grade cellulose paper, both unsized and unadulterated. The paper is subsequently passed through a chemical bath in which its surface is gelatinized to such an extent that, on being "built up," the various layers become as one homogeneous sheet of any thickness desired. These sheets are in turn treated to remove and neutralize the chemical reagents, after which they are dried and calendered, then cured or seasoned for a period varying up to one year, according to their thickness.

The importance of natural aging or seasoning will be appreciated when it is understood that any attempt to force this process, for the purpose of cheapening the product, invariably results in an inferior material; both the ultimate life of the fibre is shortened and its dielectric strength impaired. Properly prepared vulcanized fibre, because of its toughness, elasticity and durability, is superior to hard rubber and porcelain for electrical and mechanical purposes. In the finished form it does not shrink, warp, twist, or expand unless exposed to moisture; and



SPECIAL FIBRE PARTS



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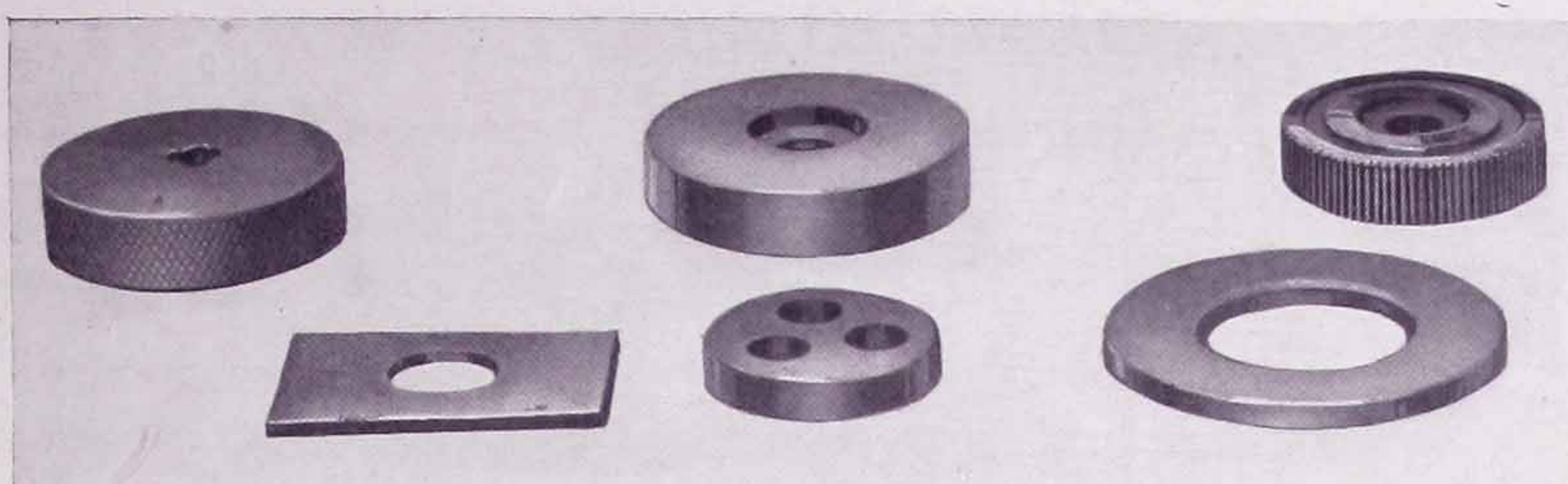
*"EVERYTHING IN INSULATION."*

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FIBRE WASHERS AND DISCS

when used in moist places it gives satisfactory service if coated with shellac, varnish or other moisture-excluding compounds.

Fibre tube is prepared in a similar manner. The paper is gelatinized and run onto steel mandrels of a size which determines the inside dimension, and the number of turns determine the wall thickness, or the outside diameter.

Fibre tube has become an important item in electrical insulation, due to its properties and ease with which it may be made into any desired shape. The tubes are being used very generally for flashlight cases, cable conductors on automobiles, vacuum cleaner nozzles and the like.

Fibre rods are made from the sheet fibre, which is cut into square bars and then run through a rod or dowel machine. Accurate diameters are obtained to 2 inches with 5 feet as the standard length. Additional lengths may be had at a slight extra cost.

Fibre rod may be used for same purposes as metal rod, and for any special parts usually made from metal, such as bushings, screws and push buttons.

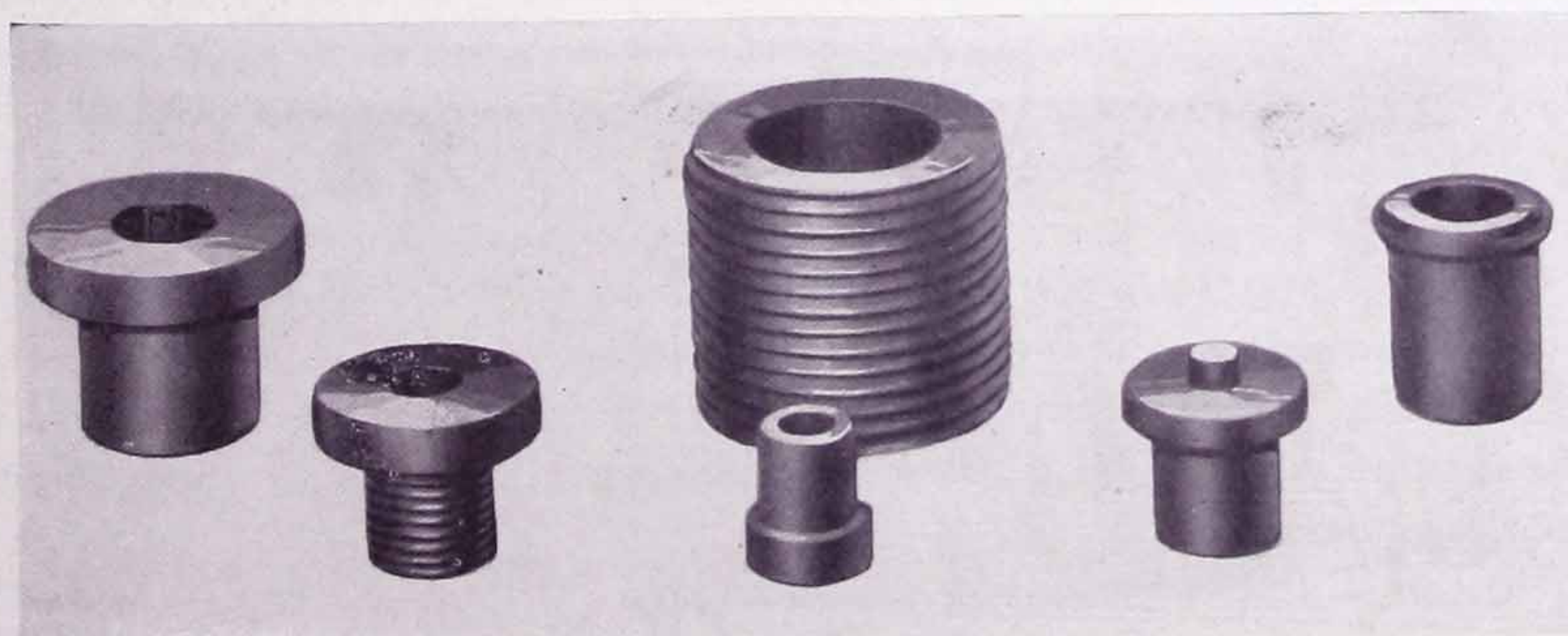
Fibre can be machined easily and accurately into practically any shape; embosses easily and takes a beautiful finish.

We invite correspondence from, and will co-operate with, manufacturers who may desire to investigate the possibilities of fibre in connection with the manufacture of their products.

See "Punchings," page 49.

Following is a list of the properties of our  $\frac{1}{8}$ " sheet fibre:

Weight of 1 sq. ft.....	0.87 lbs.
Specific gravity .....	1.380 "
Hardness by scleroscope.....	.35 "
Tensile strength per sq. in. ....	13000
Breakdown voltage .....	25000
Combustion point .....	600° F.



FIBRE BUSHINGS



## VULCANIZED SHEET FIBRE

Standard Sheets, 44"x72" (see note).

Decimal	Fraction	Approx. Weight, per Sheet	Price, per Pound
.005"		8/10	\$1.50
.010"		1-1/2	1.30
.015"		2-4/10	1.10
.016"	1/64"	2-1/2	1.10
.020"		3-1/4	1.00
.032"	1/32"	5	1.00
.047"	3/64"	7-1/2	1.00
.063"	1/16"	10	1.00
.095"	3/32"	15	1.00
.125"	1/8"	20	1.00
.187"	3/16"	30	1.02
.250"	1/4"	40	1.02
.315"	5/16"	50	1.02
.375"	3/8"	60	1.02
.433"	7/16"	70	1.02
.500"	1/2"	80	1.06
.562"	9/16"	90	1.06
.630"	5/8"	100	1.12
.748"	3/4"	120	1.18
.875"	7/8"	140	1.28
1.000"	1"	160	1.42

Colors: Red, Black and Natural (Gray-White).

\*Note—To avoid bulky packages, we ship only quarter sheets (approx. 22"x36") from the New York warehouse.

Mill shipments may be had of either full size sheets, thirds or quarters at no additional charge.

INTERMEDIATE THICKNESSES at price of the next THINNER, but sheets just under a standard thickness from 1/8" up, must vary 1/64" (.015"), or more, from the standard thickness to claim the lower price as an intermediate size.

DELIVERY—Freight charges will be allowed on shipments aggregating 100 pounds or over, to points on or east of the Mississippi River and in Ontario and Quebec, Canada. To all other points on shipments aggregating 100 pounds, or over, an allowance of 70 cents per 100 pounds will be made. Shipments to all points aggregating less than 100 pounds, F. O. B. point of shipment.

AGGREGATING—Several different thicknesses or colors may be aggregated in one shipment to determine the quantity discount. Large cut pieces 12 inches wide and more, containing 4 square feet or more, accompanying an order for sheets, may be aggregated with them to determine the sheet price and the base price for the pieces, the usual addition being made, however, on the pieces for cutting.

EXPORT ORDERS—Extra charge for packing less than 500 pounds, \$1.50 case; 500-pound lots, \$2.00 case; over 500 pounds, \$3.00 case.



# PRICE LIST OF FIBRE TUBING BY THE FOOT

Furnished in Approx. 2 to 3 Foot Lengths

Intermediate Sizes take price of next larger diameter and next thicker wall excepting between 3/16 and 1/4 I.D., when they take the price of 3/16.

A variation of .010" in O.D. is not considered an intermediate size and may be billed as a standard size.

Rectangular Tubes take double the list price of round.

I. D.	Thickness of Wall										
	1/16	3/32	1/8	5/32	3/16	7/32	1/4	9/32	5/16	11/32	3/8
1/8	\$0.40	\$0.60	\$0.80								
3/16	.40	.60	.80								
1/4	.20	.28	.36	\$0.44	\$0.52						
5/16	.20	.30	.38	.48	.56						
3/8	.22	.32	.42	.52	.62						
7/16	.22	.34	.44	.56	.66						
1/2	.24	.36	.48	.60	.72	\$0.84	\$0.96				
9/16	.26	.40	.52	.64	.78	.92	1.04				
5/8	.28	.42	.56	.70	.84	.98	1.12				
11/16	.30	.46	.60	.74	.90	1.04	1.20				
3/4	.32	.48	.64	.80	.96	1.12	1.28				
13/16	.34	.52	.68	.84	1.02	1.20	1.36				
7/8	.36	.54	.72	.90	1.08	1.26	1.44				
15/16	.38	.58	.76	.94	1.14	1.32	1.52				
1	.40	.60	.80	1.00	1.20	1.40	1.60				
1 1/8	.44	.66	.88	1.10	1.32	1.54	1.76				
1 1/4	.48	.72	.96	1.20	1.44	1.68	1.92				
1 3/8	.52	.78	1.04	1.30	1.56	1.82	2.08				
1 1/2	.56	.84	1.12	1.40	1.68	1.96	2.24				
1 5/8	.60	.90	1.20	1.50	1.80	2.10	2.40				
1 3/4	.64	.96	1.28	1.60	1.92	2.24	2.56				
1 7/8	.68	1.02	1.36	1.70	2.04	2.38	2.72				
2	.72	1.08	1.44	1.80	2.16	2.52	2.88	\$3.24	\$3.60		
2 1/8	.76	1.14	1.52	1.90	2.28	2.66	3.04	3.42	3.80		
2 1/4	.80	1.20	1.60	2.00	2.40	2.80	3.20	3.60	4.00		
2 3/8	.84	1.26	1.68	2.10	2.52	2.94	3.36	3.78	4.20		
2 1/2	.88	1.32	1.76	2.20	2.64	3.08	3.52	3.96	4.40		
2 5/8	.92	1.38	1.84	2.30	2.76	3.22	3.68	4.14	4.60		
2 3/4	.96	1.44	1.92	2.40	2.88	3.36	3.84	4.32	4.80		
2 7/8	1.00	1.50	2.00	2.50	3.00	3.50	4.00	4.50	5.00		
3	1.04	1.56	2.08	2.60	3.12	3.64	4.16	4.68	5.20	\$5.72	\$6.24
3 1/8	1.08	1.62	2.16	2.70	3.24	3.78	4.32	4.86	5.40	5.94	6.48
3 1/4	1.12	1.68	2.24	2.80	3.36	3.92	4.48	5.04	5.60	6.16	6.72
3 3/8	1.16	1.74	2.32	2.90	3.48	4.06	4.64	5.22	5.80	6.38	6.96
3 1/2	1.20	1.80	2.40	3.00	3.60	4.20	4.80	5.40	6.00	6.60	7.20
3 5/8	1.24	1.86	2.48	3.10	3.72	4.34	4.96	5.58	6.20	6.82	7.44
3 3/4	1.28	1.92	2.56	3.20	3.84	4.48	5.12	5.76	6.40	7.04	7.68
3 7/8	1.32	1.98	2.64	3.30	3.96	4.62	5.28	5.94	6.60	7.26	7.92
4	1.36	2.04	2.72	3.40	4.08	4.76	5.44	6.12	6.80	7.48	8.16
4 1/8	1.40	2.10	2.80	3.50	4.20	4.90	5.60	6.30	7.00	7.70	8.40
4 1/4	1.44	2.16	2.88	3.60	4.32	5.04	5.76	6.48	7.20	7.92	8.64
4 3/8	1.48	2.22	2.96	3.70	4.44	5.18	5.92	6.66	7.40	8.14	8.88
4 1/2	1.52	2.28	3.04	3.80	4.56	5.32	6.08	6.84	7.60	8.36	9.12
4 5/8	1.56	2.34	3.12	3.90	4.68	5.46	6.24	7.02	7.80	8.58	9.36
4 3/4	1.60	2.40	3.20	4.00	4.80	5.60	6.40	7.20	8.00	8.80	9.60
4 7/8	1.64	2.46	3.28	4.10	4.92	5.74	6.56	7.38	8.20	9.02	9.84
5	1.68	2.52	3.36	4.20	5.04	5.88	6.72	7.56	8.40	9.24	10.08
5 1/8	1.72	2.58	3.44	4.30	5.16	6.02	6.88	7.74	8.60	9.46	10.32
5 1/4	1.76	2.64	3.52	4.40	5.28	6.16	7.04	7.92	8.80	9.68	10.56
5 3/8	1.80	2.70	3.60	4.50	5.40	6.30	7.20	8.10	9.00	9.90	10.80
5 1/2	1.84	2.76	3.68	4.60	5.52	6.44	7.36	8.28	9.20	10.12	11.04
5 5/8	1.88	2.82	3.76	4.70	5.64	6.58	7.52	8.46	9.40	10.34	11.28
5 3/4	1.92	2.88	3.84	4.80	5.76	6.72	7.68	8.64	9.60	10.56	11.52
5 7/8	1.96	2.94	3.92	4.90	5.88	6.86	7.84	8.82	9.80	10.78	11.76
6	2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00	10.00	11.00	12.00



## FIBRE RODS

Furnished in Approx. 5 to 6 Foot Lengths.

## PRICE LIST

Diameter	Feet per Pound	9 Feet or Less	10 to 24 Feet	25 to 49 Feet	50 to 99 Feet	100 to 499 Feet	500 to 999 Feet	Pound Price
$\frac{3}{32}$	241	\$0.30	\$0.24	\$0.20	\$0.16	\$0.14	\$0.12	\$28.92
$\frac{1}{8}$	136	.30	.24	.20	.16	.14	.12	16.32
$\frac{3}{16}$	60	.30	.24	.20	.16	.14	.12	7.20
$\frac{1}{4}$	34	.32	.28	.22	.18	.16	.14	4.76
$\frac{5}{16}$	22	.36	.30	.24	.20	.18	.16	3.52
$\frac{3}{8}$	15	.40	.34	.28	.24	.22	.20	3.00
$\frac{7}{16}$	11	.48	.42	.36	.32	.28	.24	2.64
$\frac{1}{2}$	8.5	.60	.50	.40	.36	.32	.30	2.54
$\frac{9}{16}$	6.7	.72	.60	.50	.40	.36		2.40
$\frac{5}{8}$	5.4	.84	.72	.60	.50	.42		2.26
$\frac{11}{16}$	4.5	1.00	.84	.70	.60	.50		2.24
$\frac{3}{4}$	3.8	1.20	1.00	.80	.66	.60		2.28
$\frac{13}{16}$	3.2	1.44	1.16	.90	.72			2.30
$\frac{7}{8}$	2.8	1.68	1.32	1.00	.84			2.34
$\frac{15}{16}$	2.4	2.00	1.50	1.20	1.00			2.40
1	2.1	2.40	1.80	1.40	1.20			2.52
$1\frac{1}{8}$	1.7	3.00	2.00	1.60				2.72
$1\frac{1}{4}$	1.4	4.00	3.00	2.40				3.36
$1\frac{3}{8}$	1.1	5.00	4.00	3.50				3.84
$1\frac{1}{2}$	.94	6.00	5.50	5.00				4.70
$1\frac{5}{8}$	.80	7.00						5.60
$1\frac{3}{4}$	.69	10.00						6.90
$1\frac{7}{8}$	.60	16.00						9.60
2	.53	24.00						12.72
$2\frac{1}{4}$	.42	36.00						15.12
$2\frac{1}{2}$	.34	50.00						17.00

These pound prices do not apply except on maximum quantities

Intermediate sizes at next higher price, except sizes not more than .015" over size take the price of the standard size. Different sizes cannot be aggregated in determining the quantity price.

CUT RODS—When cut in lengths of 16 inches and over add 10 per cent. for cutting.

POUND PRICE—Domestic orders for quantities larger than that for which a foot price is given and all export orders may be billed by the minimum foot price or by the pound price.

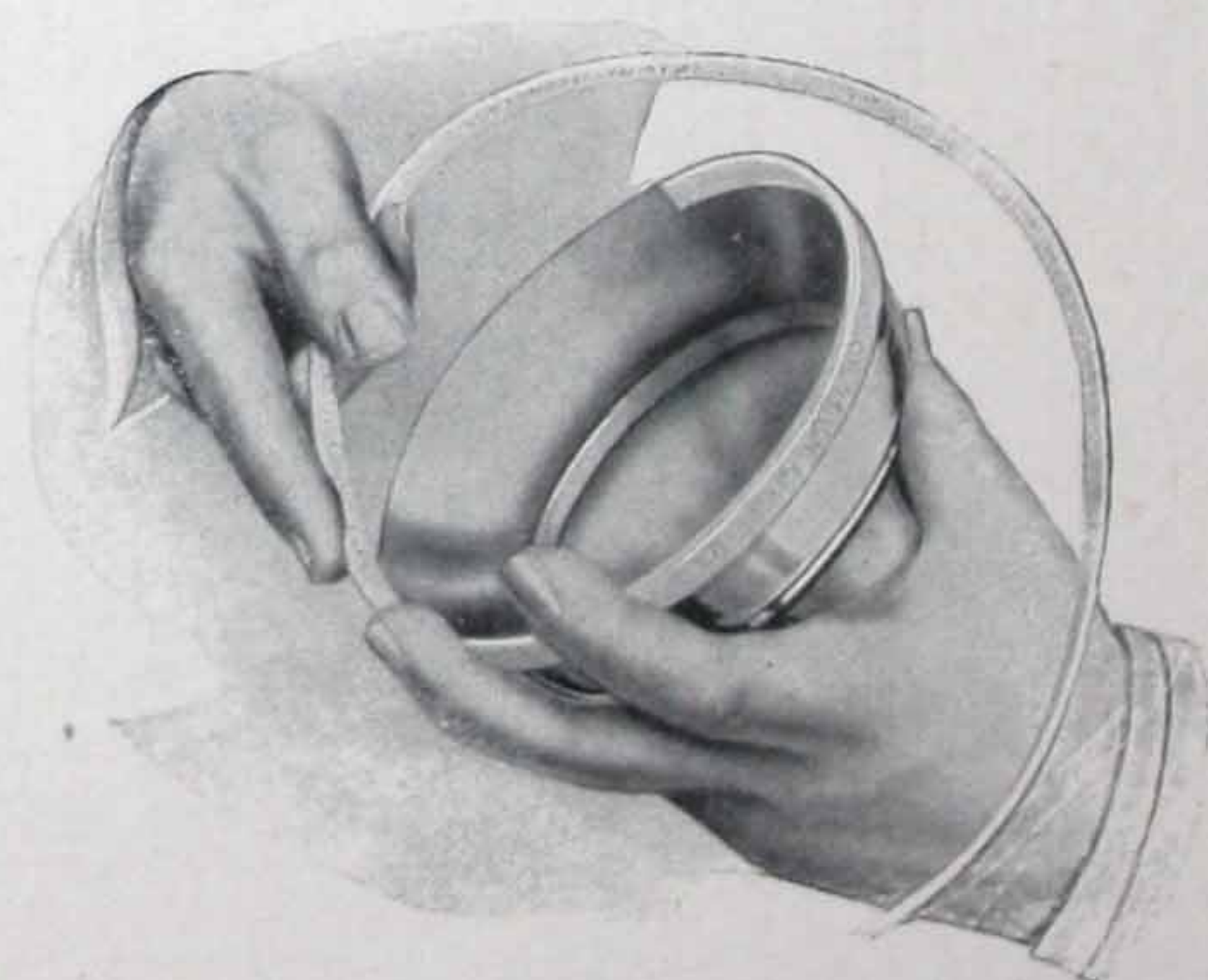
DELIVERY—Same as sheets.

The feet per pound will vary with the grade of fibre, and are not guaranteed.

## KNU-CANOPY

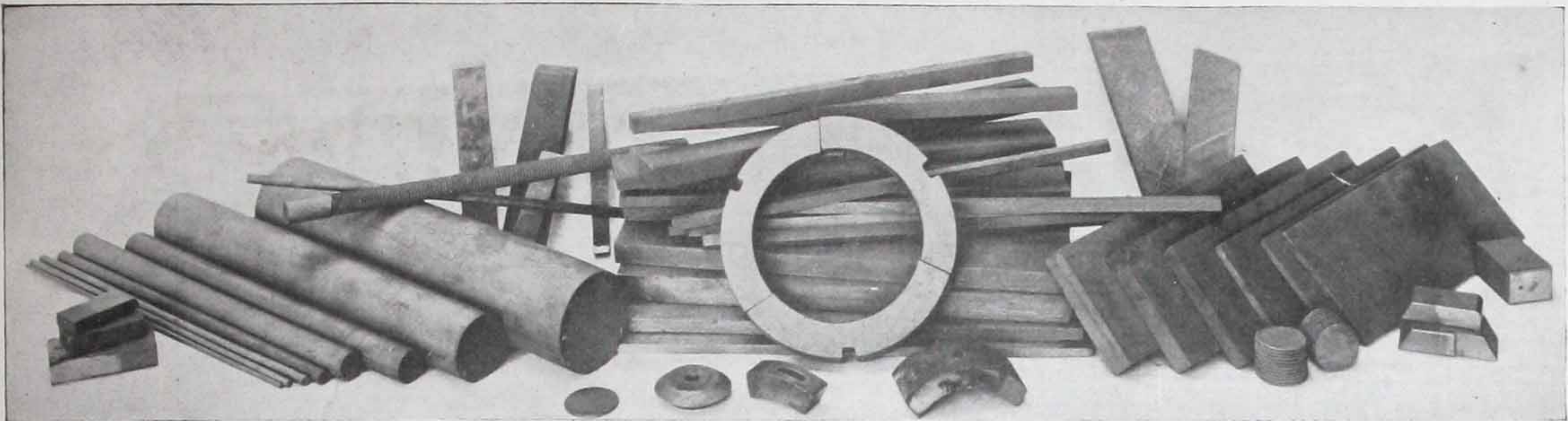
This insulator is made of white fibre, and may be applied to a canopy of any diameter without the use of tools. With a little practice 60 to 100 canopies can be insulated in an hour. It does not mar the appearance of the canopy, but rather improves it. Lowest in cost and best in appearance.

Standard Package	200 rolls	\$0.50 each list
Broken	100 "	.63 "
"	50 "	.70 "
"	25 "	.80 "





## CARBON



A large assortment of carbon strips and rods is carried in stock at all times.

### GRADE C CARBON

This produces what is known as the commercial grade, or treated brush which is self-lubricating. It is recommended for use on motors and generators which are not overloaded and are of medium speed. Sceleroscape hardness 40 degrees; carrying capacity 30 amperes per sq. in. of contact surface; resistance .0015 ohm per cubic inch; maximum commutator speed 3500 feet per minute.

For those who prefer to cut their own brushes, we supply this grade in plates 12"x6" in the following thickness at indicated prices:

1/4 inch	5/16 inch	3/8 inch	7/16 inch
\$2.00	2.32	2.32	2.70
1/2 inch	9/16 inch	5/8 inch	3/4 inch
\$2.70	3.10	3.10	3.50
7/8 inch	1 inch	1 1/8 inch	1 1/4 inch
\$3.90	4.30	4.72	5.14
1 3/8 inch	1 1/2 inch		
\$5.40	\$5.94		

### GRADE L-1 CARBON

Especially recommended where effort is made to standardize on one grade for factory and isolated plant service, it being as close to the "universal" type as is possible to manufacture. It is today in wide use and giving uniformly satisfactory service. An outstanding feature is that it rarely picks up copper and, therefore, will not score commutators. Current density 40 amperes per sq. in.; hardness 50 degrees; resistance .0014; commutator speed from 3500 to 4500 and under. Not sold in plates.

### GRADE GC CARBON

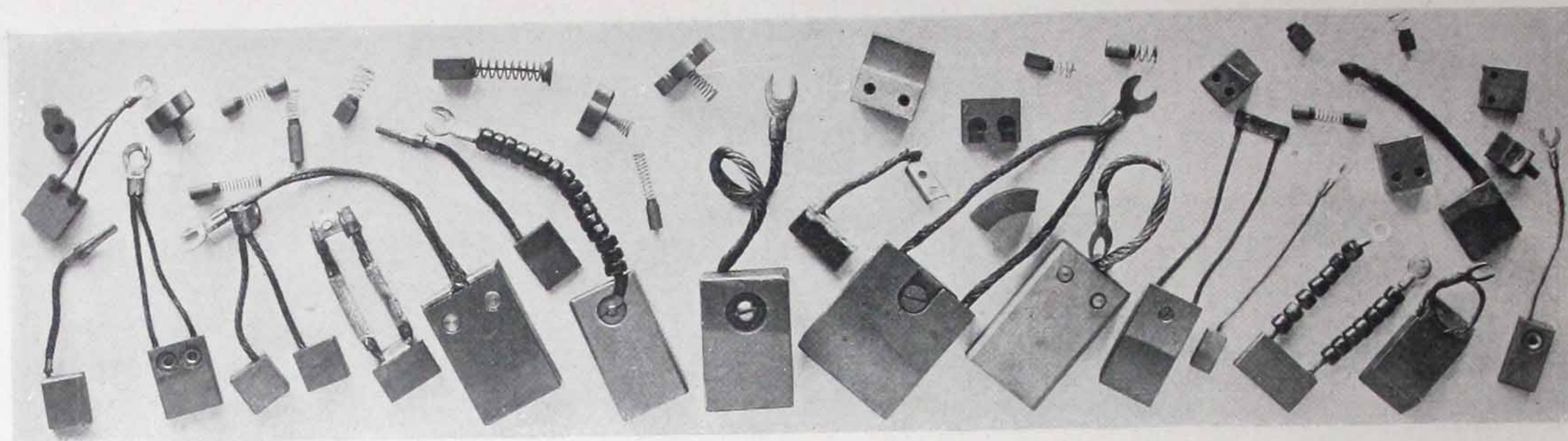
This grade should only be used where the current density is 60 amperes or over; it is of very low resistance—in fact about as low as can be used on a high voltage machine. Particularly advantageous for slip rings as it requires no lubrication. Current density 60 amperes; hardness 37; resistance .0008; commutator speed 6000 feet or over. It is not as soft as brushes generally used under these specifications, but will run absolutely noiseless. Not sold in plates.

### GRADE F-1 CARBON

An ideal brush for generator and motor work at all normal voltages on slotted commutators or commutators with soft mica; of tough, dense structure and assumes a high polish. This is an electro-graphitic brush, of good conductivity, low friction coefficient and of high commutating qualities. Resistance .0011; carrying capacity 50 amperes; hardness 37; commutator speed 4000 feet per minute. Ideal for inter-urban railways or heavy traction motors. Also furnished in strips 8"x2" of various thickness—prices on application.



## BRUSHES



Our facilities enable us to make prompt shipments of starting, lighting and magneto brushes of either copper gauze or carbon.

Copper gauze brushes are made of a cloth of the highest conductivity, wound with a lap and have no loose ends; unless otherwise specified they will be furnished wound stiff, as this form gives general satisfaction. Price on application.

In the purchase of carbon brushes care should be used not only in the selection of quality, but the characteristics of the carbon should be considered with respect to the machine on which it is to be used. In this connection we present descriptions of a few of our various grades:

## BINDING WIRE.

Tinned steel armature binding wire varies considerably in tensile strength; the wire which we offer tests 220,000 pounds per square inch and will be found of a grade considerably above average.

Standard Coils: 5 to 75 pounds each.

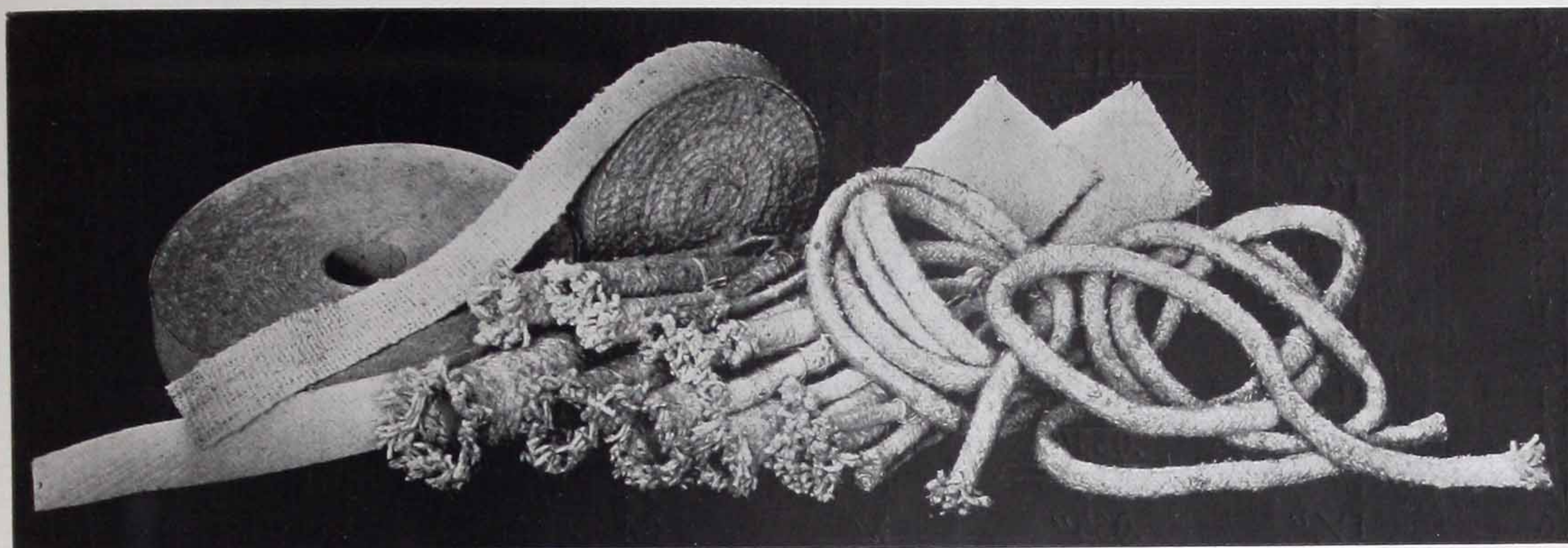
Standard Spools: 5, 10, 25, 50 and 100 pounds.

B. & S. Gauge	Diam. Mils	Actual Tensile Strength	List Price per Pound On Spools		
			5 lbs.	10 lbs.	25 lbs.
10	101.9	1,631 lbs.	\$0.80	\$0.66	\$0.55
11	90.7	1,292 "	.80	.66	.55
12	80.8	1,026 "	.80	.66	.55
13	72.0	814 "	.80	.66	.55
14	64.1	645 "	.80	.66	.55
15	57.1	512 "	.80	.66	.55
16	50.8	405 "	.82	.68	.56
17	45.3	322 "	.84	.70	.58
18	40.3	255 "	.86	.72	.60
19	35.9	202 "	.94	.80	.68
20	32.0	161 "	1.08	.94	.80
21	28.5	128 "	1.12	.98	.84
22	25.3	101 "	1.20	1.06	.90
23	22.6	80.2 "	1.26	1.08	.92
24	20.1	63.5 "	1.40	1.20	1.04
25	17.9	50.3 "	1.56	1.36	1.16
26	15.9	39.7 "	1.70	1.52	1.30

Larger quantities special prices.



## ASBESTOS



Asbestos has been known for ages, but its geological history and formation are still matters of conjecture. It is a fibrous mineral that can be spun and woven into fabrics as fine as silk, which are unaffected by temperatures of from 2000° to 3000° F. This material is found in layers filling fissures in certain serpentine rocks and it is believed that when the rock was forming, and while still hot, water penetrated the fissures, widened them and dissolved some of the silicate of magnesia; the threadlike crystals building up from opposite walls and meeting in the middle. No one has yet discovered how finely asbestos fibres can be split. A microscope magnifying 900 diameters revealed fibres that are estimated to be five one-millionths of an inch thick.

This remarkable mineral, which is not alone fireproof but also impervious to the action of acids, is found in Italy, China, South Africa, Russia and Canada; extensive deposits are also being worked in Arizona, California, Wyoming and Montana. Depending upon their source, the fibres are sometimes long, delicate, flexible and elastic; at other times they are short, stiff and brittle, each sort having its advantage for different purposes.

It is generally conceded that the highest grade for textile purposes comes from Canada—the Province of Quebec supplying a loose, silky, flax-like fibre of high tensile strength and, what is important to the electrical industry, free of iron.

After the mineral is mined, or rather quarried, it is crushed; the long fibres are carded and spun into yarn in a similar manner to that employed in the production of cotton or wool; the yarn, in turn, is woven into listing and cloth, or braided into sleeving—for which purposes the short fibres should never be used. Only the highest grade of long fibre Canadian is used in the production of Shield Brand asbestos textiles and they are unique in their uniformity, texture, tensile strength and durability.



## SHIELD BRAND ASBESTOS LISTING

No.	Width	Thickness	Diameter of Roll	Weight, per Roll	Yards, per Roll	List Price, per Pound
1	1/2"	.015"	3 1/2"	2 1/2 oz.	18	\$12.10
3	1"	.01 "	5"	7 "	28	10.56
2	3/4"	.015"	5"	9 "	28	9.90
4	1 1/4"	.015"	6"	16 "	35	9.36
5	1 1/2"	.015"	6"	18 "	35	9.36
6	1/2"	.020"	3 1/2"	3 1/4 "	18	9.36
7	3/4"	.020"	5 1/2"	9 "	35	9.36
8	1"	.020"	5 1/2"	12 "	35	8.80
9	1/2"	.025"	3 1/2"	2 1/4 "	18	8.80
10	3/4"	.025"	6"	9 "	30	7.16
11	1"	.025"	6"	13 "	30	6.60
12	1 1/4"	.025"	6"	16 "	30	6.60
13	1 1/2"	.025"	6"	19 "	30	6.60
14	3/4"	.035"	7"	13 "	35	6.06
15	1"	.035"	6 1/2"	14 "	30	5.50
16	1 1/4"	.035"	7"	24 "	35	5.50
17	1/2"	.063"	7"	16 "	14	5.50
18	3/4"	.063"	8"	32 "	18	3.96
19	1"	.063"	11 1/2"	48 "	42	3.96
20	1 1/2"	.063"	12 1/2"	80 "	48	3.80
21	2"	.063"	12"	112 "	46	3.80
22	3"	.063"	14"	160 "	53	3.60

## SHIELD BRAND ASBESTOS SLEEVING

No.	I. D.	O. D.	Approx. Feet per Pound	List Price, per Pound
101	20 wire	1/8"	167	\$4.50
102	3/32"	7/32"	71	3.50
103	1/8"	5/32"	125	5.00
104	1/8"	1/4"	67	5.00
105	3/32"	1/4"	90	3.50
106	3/16"	5/16"	50	3.50
107	1/8"	1/4"	70	3.50
108	5/32"	5/16"	50	3.50
109	1/4"	5/16"	49	3.50
110	5/16"	3/8"	40	3.00
111	3/8"	1/2"	26	3.50
112	1/2"	5/8"	19 1/2	3.50
113	5/8"	3/4"	14	3.50
114	3/4"	15/16"	13	3.50
115	1"	1-1/8"	9	3.50

## SHIELD BRAND—ASBESTOS CLOTH AND YARN

These products are manufactured to meet either sample or specifications and include asbestos packing, brake linings, etc., etc.



## SHIELD BRAND—ASBESTOS PAPER AND ASBESTOS PAPER TAPE

Asbestos paper lends itself readily to adulteration; but weighted paper has considerably less yardage, is of low tensile strength and invariably brittle.

Standard Rolls: 100 lbs. 36" wide.

No.	Thickness	Square Feet to Pound	Yards to Roll	Pounds 100 sq. ft.	List Price, per Pound per Roll
203	.007"	35	370	3	\$0.60 lb.
204*	.010"	32	344	4	0.50 "
205	.012"	25	260	5	0.40 "
206*	.015"	17	185	6	0.32 "
208	.018"	13	139	8	0.30 "
210*	.021"	10	111	10	0.24 "
212	.024"	8	92	12	0.24 "
214	.028"	7	79	12	0.24 "
216*	.030"—(1/32")	6	67	16	0.24 "
232*	.063"—(1/16")	3-1/3	37	32	0.24 "
264	.125"—(1/8")	1- 7/8	18	75 (Rollboard)	0.24 "

\*Carried in stock at warehouse.

Asbestos paper is also furnished in tape form in 100-lb. lots or multiples. Complete 100-lb. rolls of paper, 36" wide, are cut to the required width, or assorted widths; an allowance of 1/2" should be figured at each end of the roll for trim.

Asbestos paper tape will be found vastly superior to insulating papers where very high temperatures are present, because as it will not carbonize; and its economy is a further recommendation. While asbestos paper does not possess the tensile strength of listing, its use is increasing in work where listing is too expensive, or where tensile strength is not really essential.

See "Slitting," page 49.

## SHIELD BRAND—EBONESTOS

(Ebony Asbestos Wood)

A combination of asbestos, cement and an insulating compound, far superior to slate or marble in dielectric and mechanical strength; of one-third less weight and as readily cut, nailed, sawed and drilled as hard wood, it offers an excellent material for switch bases, panel boards, etc., particularly in situations subject to constant vibration or repeated shock. Ebonestos neither warps, shrinks nor cracks; it is impervious to the action of commercial acids and chemicals; withstands highest voltages; waterproof; lasts indefinitely whether indoors or exposed to the elements.

Standard Sheets, 36"x48" or 42"x96".

No.	Thickness	Weight, per sq. ft.	Dielectric Strength	List Price, per sq. ft.
401	1/8"	1.5 lbs.	12000	\$1.20
402	3/16"	2.08 "	19000	1.60
403	1/4"	2.75 "	25000	1.67
404	5/16"	3.5 "	28000	1.91
405	3/8	4.25 "	30000	2.00
406	1/2"	5.43 "	33000	2.53
407	5/8"	6.88 "	37000	3.13
408	3/4"	7.85 "	43000	3.23
409	7/8"	9. "	54000	3.53
410	1"	10.35 "	76000	3.73



# EBONITE

(Hard Rubber)

Rubber Gum, or Caoutchouc, is obtained from the milky juice of various trees and plants in South America. It is nearly white when pure. The sap obtained from the trees of Para (in Brazil) furnishes the best quality, called "Para" Rubber, which is standard. When mixed or rolled with sulphur, etc., it may be made into any shape and afterwards vulcanized by heat of 150° centigrade. The vulcanizing decreases the elasticity and increases the insolubility. This composition is called Vulcanized Rubber—more familiarly known as Ebonite. It takes a high polish, is black in color; will not stand temperature above 200° F. without becoming soft and eventually disintegrating.

Furnished in sheets, tubes and rods, in several grades, quality being determined by the percentage of the rubber content, and may be made into many special forms for instrument handles, ignition apparatus, telephone work, etc.

## List Prices for Sheets, Rods and Tubes.

Commercial Ebonite .....	\$1.94 per lb.
Electric Ebonite .....	2.60 " "
Ebonite Para .....	3.90 " "

The following tables show stock sizes:

### EBONITE SHEETS

20"x48".

Thickness	Weight, per Sheet (Approx.)
1/16"	2 1/2 lbs.
1/8"	5 "
5/32"	5 3/4 "
3/16"	8 "
1/4"	10 1/2 "
5/16"	12 3/4 "
3/8"	16 "
7/16"	18 1/2 "
1/2"	21 "
9/16"	23 "
5/8"	26 "
3/4"	30 "
7/8"	35 "
1"	40 "
1-1/4"	50 "
1-3/8"	55 "
1-1/2"	60 "
1-5/8"	65 "
1-2/4"	70 "

### EBONITE TUBES

24" lengths.

Diameter,		Approx. Weight	
Outside	Inside	22 tubes to 1 lb.	
1/4"	1/16"	23	" " 1 "
1/4"	3/32"	27	" " 1 "
1/4"	1/8"	14	" " 1 "
5/16"	1/16"	16	" " 1 "
5/16"	1/8"	20	" " 1 "
5/16"	3/16"	9	" " 1 "
3/8"	1/16"	9	" " 1 "
3/8"	1/8"	15	" " 1 "
3/8"	1/4"	8	" " 1 "
7/16"	1/8"	6	" " 1 "
1/2"	3/16"	8	" " 1 "
1/2"	5/16"	7	" " 1 "
1/2"	1/4"	5	" " 1 "
5/8"	3/8"	4	" " 1 "
5/8"	1/4"	4 1/2	ounces per tube
1/8"	3/16"	4 1/2	" " " "
3/4"	1/2"	5 1/2	" " " "
3/4"	3/8"	4	" " " "
3/4"	1/2"	10 1/2	" " " "
1"	1/2"	6	" " " "
1"	3/4"	13	" " " "
1-1/4"	3/4"	1-1/4"	1"
7 1/2	"	"	"

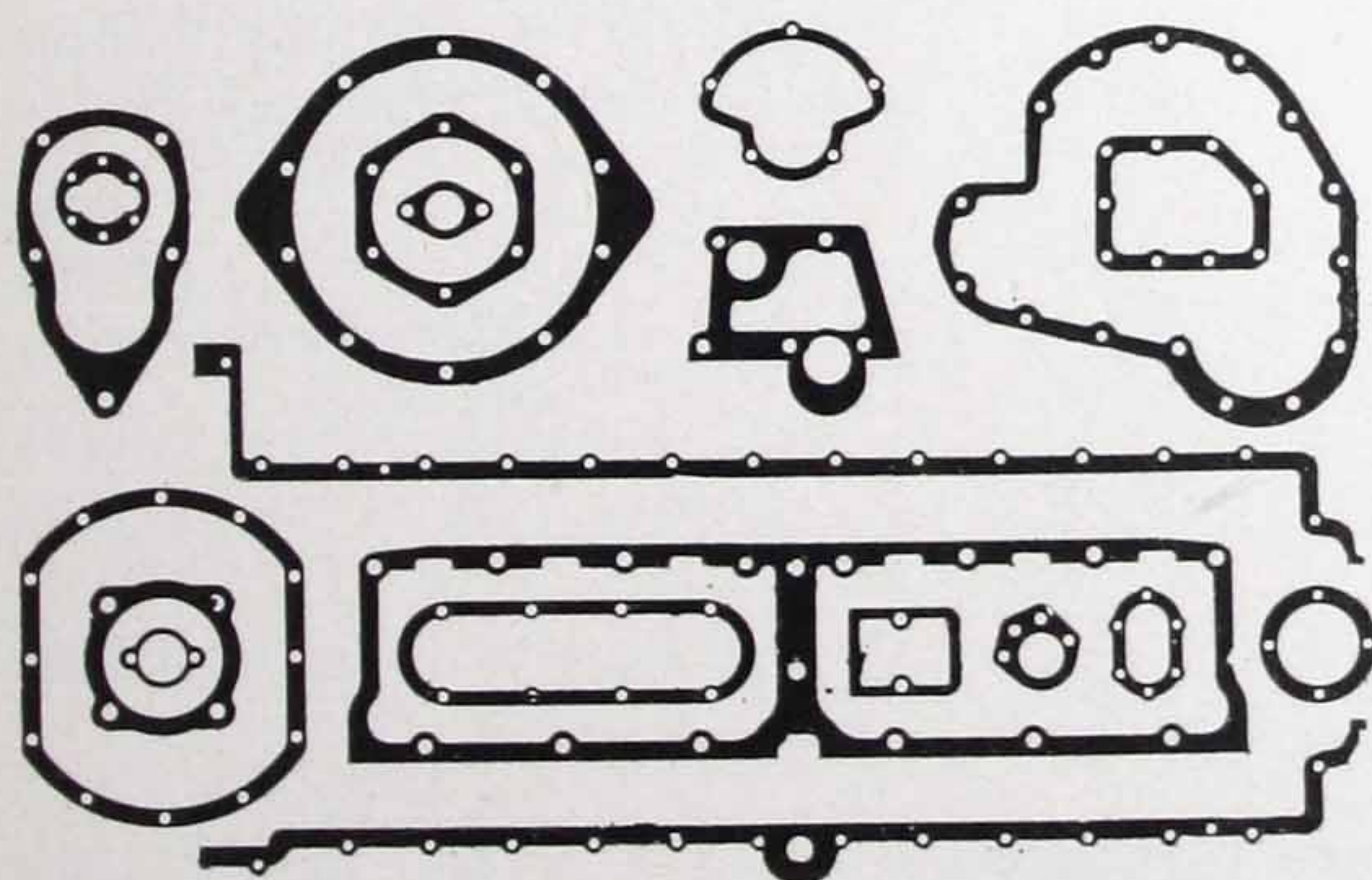


## EBONITE RODS

24" lengths.

Diameter	Approx. Weight
1/4"	18 rods to 1 lb.
5/16"	13 " " 1 "
3/8"	8 " " 1 "
7/16"	7 " " 1 "
1/2"	5 " " 1 "
9/16"	4 " " 1 "
5/8"	3 " " 1 "
11/16"	6 ounces per rod
3/4"	7 " " " "
13/16"	8 1/2 " " " "
7/8"	9 1/2 " " " "
15/16"	11 1/2 " " " "
1"	13 " " " "
1-1/16"	14 1/2 " " " "
1-1/8"	1 lb. per rod
1-3/16"	1 " 2 1/2 ounces per rod
1-1/4"	1 " 4 1/2 " " " "
1-5/16"	1 " 7 " " " "
1-3/8"	1 " 9 " " " "
1-7/16"	1 " 10 1/2 " " " "
1-1/2"	1 " 13 1/2 " " " "
1-9/16"	1 " 15 1/2 " " " "
1-5/8"	2 " 4 " " " "
1-3/4"	2 " 7 1/2 " " " "
2"	3 " 3 " " " "
2-1/4"	4 " 2 " " " "
2-1/2"	5 " 2 " " " "

## PUNCHINGS



We are prepared to furnish special stampings of any shape and size in fibre, pressboard, paper, varnished materials, mica plate, etc. Prices will be quoted on receipt of sample or drawing.

## SLITTING

Rolls of varnished or untreated silk, paper, cloth, canvas, duck, etc., can be readily slit into tape of any desired width, or assorted widths, but orders will be received only for quantities which aggregate one or more complete 50-yard rolls. An allowance of 1/4" for trim at each end of the roll should always be made. Thus, a 50-yd. roll of varnished silk (36" wide, less 1/2" trim) will produce 35 rolls of 1" Varnished Silk Tape—or 47 rolls 3/4" wide—or 71 rolls 1/2" wide, etc., each roll 50 yards long.

For a single roll of any material to be cut into tape, the additional net cost, covering setting of machine and labor, may be closely approximated at 20% of the price of the complete roll, but this slitting charge is reduced as the quantity is increased. Estimates will be promptly furnished on application.

Where 2-ply or 3-ply paper tape is ordered special quotations should be secured.

## VELLUMOID PACKING

The base of Vellumoid Sheet Packing is a very strong vegetable fibre, chemically treated to render it exceedingly tough and oil, water, gasoline, grease and air proof, making an exceptional gasket for use on all oil, grease, water and gasoline connections. The only places for which we cannot recommend it is where temperatures run over 300° F.

It contains no rubber, rubber substitute or mineral matter; is light in weight, very flexible and has high tensile and tearing strength. Because of its flexibility it makes a particularly tight joint and its toughness insures durability.

No.	Thickness	Weight, per sq. yd.	List Price
1	.006"	4 oz.	\$0.70 yd.
2	.010"	9 "	1.20 "
3	.015"	15 "	1.80 "
4	.021"	19 "	2.40 "
5	.032"	26 "	2.60 "
6	1/16"	3.3 lbs.	2.00 "
7	1/8"	6.7 "	2.20 "

See "Punching."



## BLEACHED GLASSINE PAPER

This paper is extensively used in the manufacture of condensers, for which purpose it is particularly recommended because of its freedom from pin holes. Thickness approximately .0015"; tests about 12 points on the Mullen Tester. Absolutely oil and moisture proof.

Stock sizes	Sheets, Approx. weight, per ream	List Price, per pound (Full reams only)
24"x36"	25 lbs.	\$0.74
25"x40"	30 "	.74
30"x40"	36 "	.74

Special size sheets to order in 500-pound lots or more.

## Rolls.

In 500-pound lots, rolls of any width up to 44", and of any diameter, will be made to order at no increase over regular price.

For Glassine Paper Tape see "Slitting," page 49.

## PRESSBOARD

This material is also known as Fullerboard and Presspahn. It will show an average puncture voltage of 203 per mil. There are two grades, No. 1 differing from No. 2 only in toughness, permitting the board to be sharply bent without cracking. Our No. 2 grade is of an unusually high quality and will compare favorably with No. 1 of other makes. Prompt deliveries from the mill of special sizes or large quantities.

Grade	Stock Size	List Price, 100-lb. lots	
		Under .015"	.015" and Over
No. 1	30"x40"	\$0.44 lb.	\$0.48 lb.
No. 2	24"x32"	.34 "	.34 "

## Warehouse Stock Thicknesses:

No. 1—Tan or Gray:

.010", .015", .020", .025", .030", .040"

No. 2—Red:

.010", .012", .015", .017", .020", .025", .030", .035", .040", .0625", .080", .125"

See "Punchings," page 49.

*This handbook describes only a part of the varied line of materials we manufacture. Let us know what you want and we will furnish it.*

*With but few exceptions, all prices are list and subject to discounts. Write for current quotations, specifying quantities, dimensions and all other essential data.*

*The privilege of furnishing samples is requested; it is our earnest desire to acquaint you with the high grade of our products.*



## INSULATING WAXES AND COMPOUNDS

Very rarely can a hydrocarbon be found which, in its crude state, will fulfill insulation or waterproofing conditions. Working over or compounding with some other substances is necessary to secure the proper qualities.

Our business is the blending of the various crude wax, pitch, rosin and asphalt products into compositions best suited for the intended service.

Paraffine, ozokerite, ceresine, montan, carnauba, Japan and similar waxes, petroleum pitch, wax tailings, rosin, gilsonite, glance pitch, manjax, blown asphalt, California asphalt, are all examples of classes of products referred to.

These materials possess high insulating value combined with low cost. They are the lowest priced materials used for insulating and waterproofing work.

Knowledge of their qualities, particularly in combination, is largely a matter of practical experience and experiment.

Our experience in this line has extended over a quarter of a century. We have a suitably equipped laboratory and efficient chemists.

We will make compounds in any quantity—a barrel or a carload.

Our price for the finished product will probably be cheaper than the cost of the raw materials in small quantities.

As we are dealers in these crude materials, it can readily be seen that we are in a position to produce the compounds at the lowest possible price.

If a user will consider us as his compounding department, he will save on capital investment, purchasing expense, time, trouble, fire risk, storage space, chemist's cost, etc.

If special conditions are to be met, our chemists will study them and recommend the most suitable insulation.

We make these compounds in solid form to be heated for use or in paint form to be applied cold.

We will supply a compound to fulfill a given condition or if the user wishes a compound from his own formula, we will make it on a cost-plus-a-fixed-sum basis.

The most important of these compositions are: Insulating Waxes for insulated wire, Saturating Compounds, Sealing Compounds, Filling Compounds and Impregnating Compounds.



## INSULATING WAXES.

INSULATING WAX for insulated wire is known as: Ozokerite Wax, Cable Wax, Slicker Wax, Saturating Wax, Finishing Wax, etc. These waxes are used for saturating the cotton braid of rubber-covered wire, for finishing the saturated braids of both weatherproof and rubber-covered wire and in certain instances for saturating and finishing braid of rubber-covered wire in one process. The materials first used were Ozokerite Wax hardened with asphalts. The modern demands for waxes having certain properties of melting point, color, polish and lack of stickiness, etc., together with the rapid decrease of supply of Ozokerite and its corresponding increase in cost, have led to the manufacture of asphalt and paraffine mixtures, hardened with Carnauba wax, Montan wax and other materials.

A SATURATING WAX must be of low viscosity and medium melting point. It must be capable of completely penetrating the braid at a temperature of from 210° F. to 300° F. in a reasonable length of time. It must be as hard as possible to avoid softening the finishing coat applied afterwards.

THE FINISHING WAX must be of high melting point, high polish and have as much flexibility as possible to avoid cracking and chipping when the wire is bent. Finishing waxes are made to meet different specifications.

A COMBINATION WAX has to a large extent the properties of both saturating and finishing waxes.

### Process of Saturating Rubber-Covered Wire.

The wire is drawn through a bath of melted wax and wiped as it leaves the tank. The temperature of the wax is from 210° to 280° F. The tanks are arranged so that the wire remains in the wax from 5 to 15 seconds. If the wax does not saturate with the given speed of the wire the temperature of the bath is increased or the time in the bath lengthened. This may be accomplished by looping the wire so that it remains in the bath twice as long. The saturated wire is reeled up and set aside for finishing on the following day.

Our Standard Code Saturating Wax No. 1703 has the following characteristics:

Melting Point, 124° F.	Specific Gravity at:
Viscosity at:	60° F. ....0.9227
270° F. ....1.3793	Penetration at:
250° F. ....1.4828	70° F. ....0.5
230° F. ....1.6724	100° F. ....56.5
210° F. ....1.8621	



### Process of Finishing Rubber-Covered Wire.

The saturated wire is drawn through the tanks of finishing wax in the same manner as in saturating rubber-covered wire. The finishing wax should be kept at as low a temperature as possible, and the wire drawn through as rapidly as convenient. The lower the temperature and the higher the speed the less chance the softer and more sticky saturating compounds have of softening the finishing coat. The excess of finishing wax is removed with a wiper. When the finishing wax has become cold the wire is drawn through tight-fitting steel dies. This process smoothes the surface and brings out the desired high polish.

Our Standard Code Finishing Wax No. 1921 has the following characteristics:

Melting Point, 156° F.	Specific Gravity at:
Viscosity at:	60° F. ....0.9765
290° F. ....2.7069	Penetration at:
270° F. ....3.6552	70° F. ....1.0
250° F. ....4.7586	100° F. ....16.0
	120° F. ....90.0

Our facilities and experience enable us to produce Finishing Waxes to meet special factory conditions.

We also manufacture a combination Saturating and Finishing Wax used for saturating and finishing rubber-covered wire in one operation.

All these waxes are moulded in cakes weighing about 55 pounds each and packed three to a bag. Measurements of each package approximately 14" x 15" x 30".

## SATURATING COMPOUNDS.

Saturating Compounds for saturating weatherproof wire are usually a mixture of pitches of the petroleum residuum type with wax tailings or pine tar. As weatherproof wire is sold by weight, the demand is generally that the saturating compounds be as heavy, i.e., have as high a specific gravity, as possible. The nature of such compounds necessitates the use of higher temperatures and much longer periods of saturation than with saturating waxes. All these mixtures are not true chemical compounds, technically they are solid solutions. We might consider the asphaltic and pitch constituents as the component dissolved in the wax solvent. It is therefore necessary to have the two components balanced properly. If this is not the case the continued holding of the melted mixtures at the temperature required would tend to cause a separation or precipitation; such a mixture would not only be worthless for insulating purposes but would clog the tank and settle on the steam coils, causing great annoyance and loss of heat.

### Process of Saturating Weatherproof Wire.

An iron reel of wire is lowered into the tank containing the melted compound. By means of steam coils the compound is kept at a temperature of from 300° to 350° F. Saturation is complete in from ten to fifteen minutes. The wire is then drawn off through a wiper and reeled on wooden reels. The wiper consists of sev-



eral pieces of burlap arranged to surround the wire and remove the excess of compound as the wire leaves the tank. The reels of saturated wire are then allowed to cool, usually over night. The following day they are finished.

Our Standard "A" Compound has the following characteristics:

Melting Point, 150° F.

Viscosity at:

300° F. .... 3.3448  
270° F. .... 4.8848  
250° F. .... 8.2759

Specific Gravity at:

60° F. .... 1.0946

Penetration at:

70° F. .... 5.0  
100° F. .... 36.5  
120° F. .... 147.0

The Process of finishing Weatherproof Wire is the same as for Rubber-covered Wire.

Weatherproof Compound is shipped solid, in barrels, weighing about 500 lbs. each.

## SEALING COMPOUNDS.

Sealing Compounds are a class of material using rosin, pitch and asphalt as a base. They have to be heated for use. When heated, the compound melts and is readily poured, cooling again quickly and becoming hard. Most important uses are for sealing the tops of dry batteries, sealing tops of storage batteries, filling screw holes in backs of switchboards, and panel boards and covering live parts of electric fittings.



DRY BATTERY SEAL is a non-plastic material used for sealing the tops of dry batteries and flashlight batteries and is furnished in various colors. It melts freely and pours readily but hardens to a stone-like condition so that it withstands the gas pressure generated inside the battery; it sets quickly and gives a hard, glossy surface, smooth and free from bubbles.

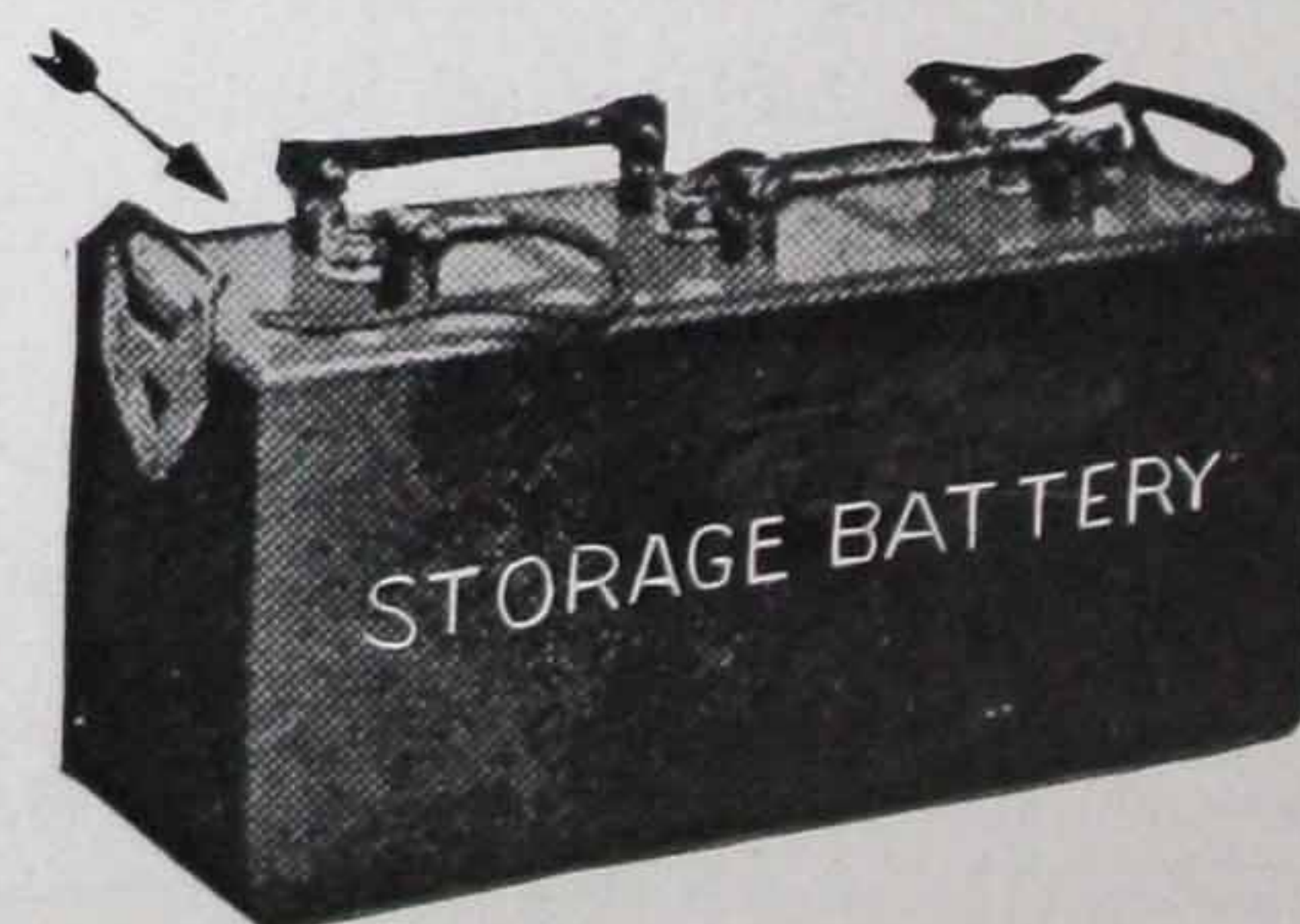
### Process of Sealing Dry Batteries.

Pieces of the Seal are placed in a small shallow melting pot over a gas burner and heated until thoroughly liquid. It is then poured with a ladle on the top of the batteries and allowed to harden. As it contains a certain proportion of mineral matter, care must be used not to heat too hot and to stir occasionally. If the wax is heated very hot for a long period without stirring the tendency of the heavier ingredients is to gravitate to the bottom of the melting pot.

It has a melting point of about 200°.

The seal is generally shipped in broken fragments so that it is readily handled. It is packed in burlap bags or in barrels. A standard package weighs about 200 pounds.

STORAGE BATTERY WAX is a black flexible compound for covering tops of storage batteries. It is flexible and durable. It will withstand the heat of summer and the cold of winter. Not affected by battery acids. Adheres to rubber and metal surfaces but can be readily dug out of the battery box when desired. At 200° this seal is sufficiently plastic to work like putty.





The seal is broken up and placed in any style of melting pot and when thoroughly liquified is poured on top of the battery. After it has cooled and solidified the surface can be gone over with a flame without any carbonizing effect. This product has been used for many years and given great satisfaction.

Melting point about 200° F.

Usually shipped in barrels weighing about 400 pounds. Can be shipped in 50-pound tin cans if desired.

SEALING CEMENT is a hard composition of a rosin base. Also called Sealing Wax or Underwriters Wax. It is used largely for filling in screw holes in the backs of switchboards and panel boards, filling holes in various kinds of porcelain pieces such as sockets and rosettes and is also used by electric sign makers for covering joints, screws and terminals.

It is approved for use by the Underwriters Laboratories.

The common method of use is to melt in a small shallow receptacle over a gas heater and when the cement is thoroughly melted it is poured with a ladle in the hole which is to be filled. Care must be taken to keep the cement stirred so that the heavier ingredients will not settle out.

Where a small deep hole is to be filled a soldering iron is employed, using the cement in stick form. By using the soldering iron the cement is kept from hardening before the hole is completely filled.

This cement can be produced in various colors.

It is generally moulded into cakes and shipped in bags, weighing about 180 pounds. It can be shipped in broken pieces in barrels for easy handling, or moulded into sticks.

## FILLING COMPOUNDS.

Under this head are included the class of black hydrocarbon compounds such as Pothead Compounds, Cable Compounds, Coil Filling Compounds and Transformer Compounds.

### POTHEAD COMPOUNDS

"H" POTHEAD COMPOUND has a melting point of 200° F.; is flexible at freezing weather and will not flow in summer heat. Weighs approximately 8.461 pounds per gallon.

NO. 63 WAX POTHEAD COMPOUND has a melting point of 126° F.; melts very thin at comparatively low temperature and flows freely so that it will fill completely very small cracks and openings. Used generally for aerial potheads. Approximately 8.08 pounds per gallon.

These compounds can be supplied in 1-gallon cans, 5-gallon cans or in barrels.

### CABLE COMPOUNDS

are used for sealing ends of cables. They are solid at normal temperatures and are liquified by heat. They are made in several different grades of hardness.

"H" CABLE COMPOUND has a melting point of 200° F. and is very flexible at normal temperatures.

"L" CABLE COMPOUND has a melting point of 320° F. and is harder at normal temperature than the "H."

Can be shipped in cans, bags or barrels.



### COIL FILLING COMPOUNDS

comprise a number of compositions varying considerably in nature and characteristics. Red Sealing Wax is sometimes used. Also mixtures of rosin and beeswax. We recommend our LEVERITE COMPOUND.

"LEVERITE" COIL FILLING COMPOUND is a black hydrocarbon compound having a flowing point of approximately 300° F. It is made from a pure asphalt base and is approved by the Board of Underwriters.

Usually shipped in barrels weighing about 500 pounds.

TRANSFORMER COMPOUND is an oilproof product for use in transformer work. It is made of a specially treated gum which resists the action of machinery oil. Is used also for coating or impregnating electrical apparatus subject to contact with oil. Flowing point 212° F.

Shipped in barrels weighing about 500 pounds.

PLOW FILLER COMPOUND is used by street railway companies equipped with underground systems on their contact plows.

Melting point at 195° to 200° F.

This compound has been particularly satisfactory during severe weather conditions because it resists temperature changes to a marked degree, is not brittle and does not crack under vibration. Shipped in barrels weighing about 500 pounds.

### IMPREGNATING COMPOUNDS.

These Compounds are used in vacuum machines for impregnating field and armature coils, etc.

#### VACUUM IMPREGNATING COMPOUNDS.

The use of the vacuum apparatus admits of the use of a much heavier melting compound than could otherwise be employed for impregnation. The compound therefore is generally of a heavy asphaltic base of high melting point so that it will not run when the coils heat up in service. Due to the fact that very heavy insulating compound can be forced into the centre of a coil by the use of a vacuum machine, this method of re-insulating coils has proven very successful.

Our Standard Compound has a melting point of about 200° F.

Usually shipped in barrels weighing about 500 pounds.

#### BRAKE LINING COMPOUNDS.

These are Compounds in liquid or paint form, which are used for impregnating asbestos brake lining. Render the lining waterproof and are made in different grades of hardness.

#### Process of Brake Lining Impregnation.

The general practice is to reduce the compound to a heavy liquid or paint by some volatile petroleum solvent. For use this paint can be still further thinned with benzine or gasoline. The paint can also be heated with good effect. On account of the inflammability of the solvent indirect heating must be used.

The lining is allowed to stay in the bath until completely saturated. It is then wiped and allowed to dry either in coils or in long strips in a drying room before cooling.

Shipped in barrels of about 50 gallons.



### BELT WATERPROOFING COMPOUND.

Fan and Transmission belts are made of cotton or canvas and are waterproofed to insure long service. The compound must be such as to leave the belt flexible and free from excessive stiffness. The belts are usually saturated with waxes similar to those used in the manufacture of rubber-covered wire. The process is substantially the same.

## SPECIAL COMPOUNDS FOR SPECIAL PURPOSES.

We manufacture various compositions for special work. These are sometimes made up by us according to a special formula furnished by the user. Under this head will cite:

RUBBER FILLER. Flexible compounds of treated asphalts for rubber compositions. Amalgamate readily with rubber. Furnished in different melting points. Give additional durability to reclaimed rubber. Pliable and not readily affected by temperature changes.

"H" Rubber Filler, melting point 200° F.

"M-R" Rubber Filler, melting point 320° F.

Generally shipped in barrels weighing about 400 pounds.

CHATTERTON COMPOUND. This is a Gutta-Percha compound for electrical purposes. Exceedingly flexible and elastic. Melts freely. Sold in stick form, 1/2 pound or 1 pound. Contains large percentage of Gutta-Percha. Used where highest degree of elasticity is required.

"M-R" CABLE BEESWAX. This is a beeswax mixture which is used for boiling out cable forms, cores, etc. Furnished in 1-pound cakes.

ELECTROTYPERS' WAX. This is a wax compound developed as a substitute for ozokerite, for electrotyping. It has been used with good success. Has the appearance of ozokerite and similar characteristics.

Moulded in cakes 55 pounds each; generally shipped in 165-pound bags.

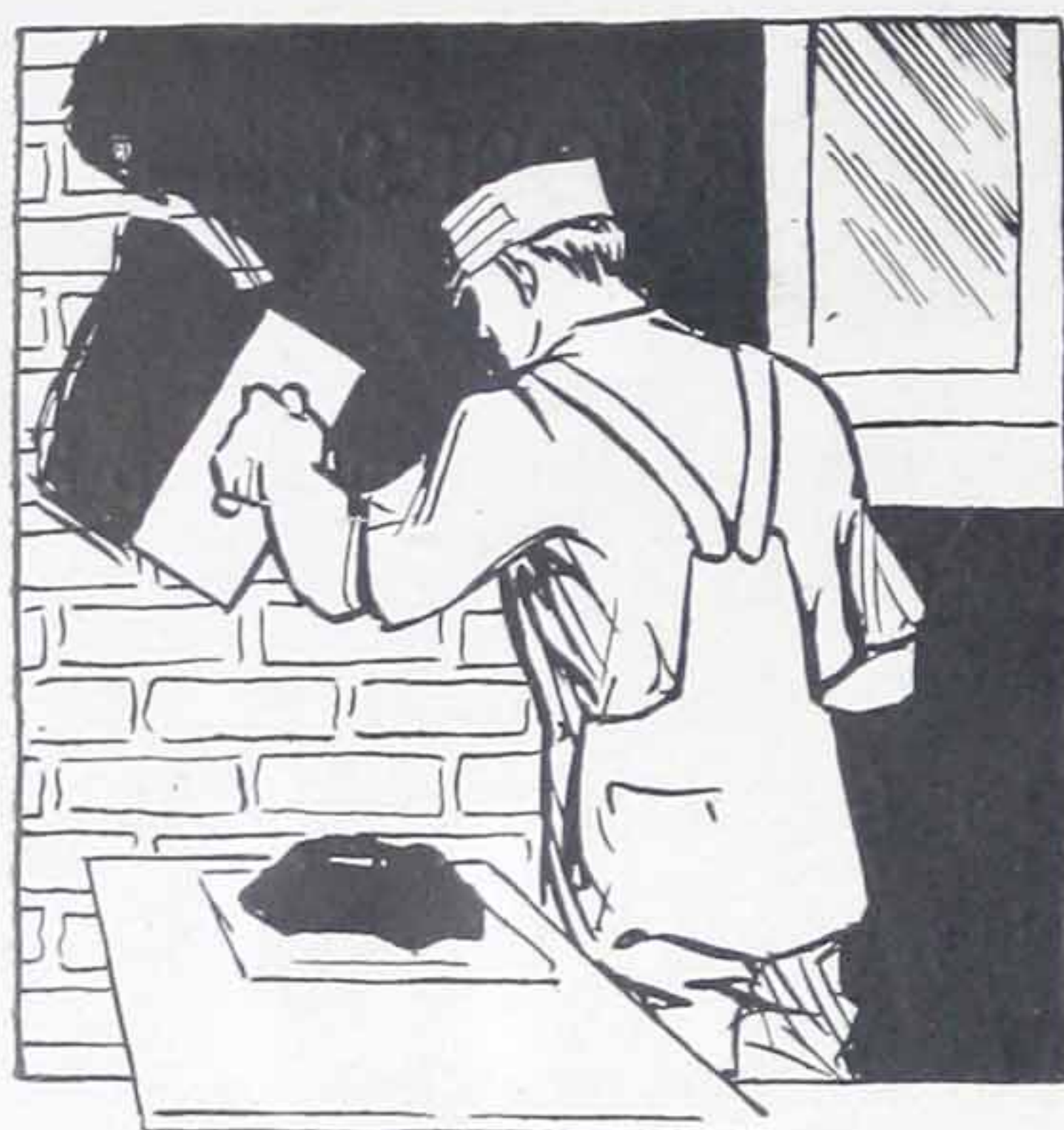


## STRUCTURAL WATERPROOFING COMPOUNDS

We have been manufacturing special water-proofing compounds for building construction for more than twenty years. These compounds have been applied to all classes of structural work and many of the largest buildings in New York City are references as to the quality and durability of our products. The success of our compounds in their special applications is due to our years of experience and to the fact that they are made up wholly in our factory under the personal supervision of our chemists.

### M-R WATERPROOF PLASTIC

#### FOR BRICK WALLS OF BUILDINGS ABOVE GRADE.



M-R Waterproof Plastic is an asphalt gum compound, containing mineral fibre, which is especially prepared for use on side walls. It is ready for use as received in original packages, no heating or thinning being necessary.

M-R Waterproof Plastic is troweled on the inner surfaces of walls exposed to the weather before furring or plastering is done. Bonds perfectly with plaster; prevents the penetration of dampness; renders the inside of walls vermin and stain proof.

M-R Waterproof Plastic is easily applied, gives absolutely protection and can be used successfully where damp-proof paints are inefficient.

Sold in barrels of 50 gallons.

Covering capacity approximately one gallon to 25 sq. ft., depending on characteristics of surface to be covered.

### M-R FURRING COMPOUND.

A glossy, black composition used on the interior of exterior brick or terra-cotta walls to which plaster is directly applied. It is applied with a brush.

Shipped in barrels,  $\frac{1}{2}$  barrels, 5 and 10-gallon cans.

Covering capacity approximately one gallon to 60 sq. ft. One coat on brick work.

### M-R STAINPROOF COMPOUND.

A black waterproof paint for waterproofing the back of limestone, bedford stone, granite, marble, or any cut stone. It is applied to the top, bed, sides, back, and to within one inch of the face to prevent staining.

Shipped in barrels,  $\frac{1}{2}$  barrels, 5 and 10-gallon cans.

Covering capacity approximately one gallon to 125-150 sq. ft.



### M-R COLORLESS COMPOUND.

A colorless liquid for damp-proofing the outside face of brick walls where it is undesirable to use a paint which would change the texture or color of the brick.

Shipped in barrels or lesser quantities.

Covering capacity approximately one gallon to 100 sq. ft., depending on characteristics of surface to be coated.

### M-R UNIVERSAL WATERPROOFING PASTE.

A composition used to waterproof mass concrete, cement, floor and wall finish and cement mortars for laying up brick and stone walls, above and below grade.

One and one-half gallons Universal Waterproofing Paste dissolved in 25 gallons of water to be used for 1 cubic yard of concrete.

One and one-half gallons Universal Waterproofing Paste dissolved in 50 gallons of water will waterproof 200 square feet of cement finish floor, wall or stucco, 1 inch thick.

One and one-half gallons Universal Waterproofing Paste dissolved in 25 gallons of water will wet 1 yard dry cement and sand for laying up brick or stone walls.

Shipped in barrels,  $\frac{1}{2}$  barrels or smaller quantities as desired.



### M-R ROOFING CEMENT

Is a plastic material, manufactured from high-grade asphaltic gums, interlaced with asbestos fibre.



It is used to make repairs on old, leaking roofs, and for entire new roofs.

It is applied with mason's or plasterer's trowel, just as received in the original packages, no heating or thinning being required, on entire roofing it makes a one-piece roof, without lap, seam or nail.

Sold in barrels or cans.

Covering capacity approximately 30 to 40 pounds to 100 sq. ft. of surface.



### M-R SEMI-PLASTIC ROOF CEMENT

Is a weatherproof compound along the lines of our Roofing Cement. It is of a softer consistency, which enables it to be readily applied with a roof brush. Used for protecting, preserving and renewing composition roofs and metal sidings. One coat only is required on the oldest surface. This one coat will seal all small holes caused by rust.

M-R Semi-Plastic is cheaper than paint. A single coat equals in thickness four or five coats of ordinary roof paint, and as a protective coating is far superior. This material will not blister or run, as it is reinforced with asbestos fibre, which holds the compound in place until it is thoroughly set.

Shipped in barrels, half-barrels or smaller quantities as desired.

Covering capacity on ordinary surfaces, approximately one gallon to 60 sq. ft. Three gallons for 100 sq. ft. on gravel roofs, according to the condition of the surfaces.

### M-R BOILER SETTING CEMENT.

M-R Boiler Setting Cement is a scientifically prepared trowel applied coating to be used on the exterior surface of boiler settings to stop air leaks.

M-R Boiler Setting Cement remains plastic for a great length of time and when put on in accordance with directions, will produce an absolutely airproof surface over the entire boiler setting. Its application is easy. Any handy man around the plant can do it. All that is required is a plasterer's trowel.

All brick surfaces are porous. Mortar is brittle. Boiler settings that have been erected for any length of time are sure to develop cracks and crevices. This condition allows the cold outside air to enter the boiler setting, greatly chilling the hot gases, thus lowering the temperature of the combustion chamber. Extra coal is therefore required to generate the necessary heat.



A conservative estimate is at least 10 per cent of the heat value of a ton of coal is lost through air leaks in boiler settings.

Sold in barrels, half-barrels and smaller quantities as desired.

Covering capacity approximately 40-50 pounds to 100 sq. ft. of setting.



### M-R ASPHALTUM PAINT.

A durable paint for woodwork, battery cradles, street car trucks and fenders, battery bodies, iron works, etc.

Sold in barrels and cans.

Coverings capacity approximately one gallon to 200 sq. ft. on metal work.

### M-R MARINE PLASTIC COATING.

A coating for the interior surfaces of ship hulls, ballast tanks, coal bunkers and fresh and salt water tanks as a protectant against deterioration. It is applied with a trowel, cold, will set in from 48 to 72 hours.

Sold in barrels of 50 gallons.

Covering capacity approximately one gallon to 60 ft. on steel plates.

### M-R DAUBER COATING

Compounded of the same materials as M-R Marine Plastic Coating but of lighter consistency. Applied cold with heavy dauber brushes to surfaces where it is impracticable to apply the Plastic Coating.

Sold in 50-gallon barrels and cans.

Covering capacity approximately one gallon to 150 sq. ft.

### M-R SMOKE-STACK PAINT.

This is a mineral asphaltic paint mixed with heat-resisting oils and compounds which enables this paint to resist heat up to a temperature of 700° F.

Sold in barrels and cans.

Covering capacity approximately one gallon to 250 sq. ft.



## DESCRIPTION OF NATURAL WAXES OF COMMERCE

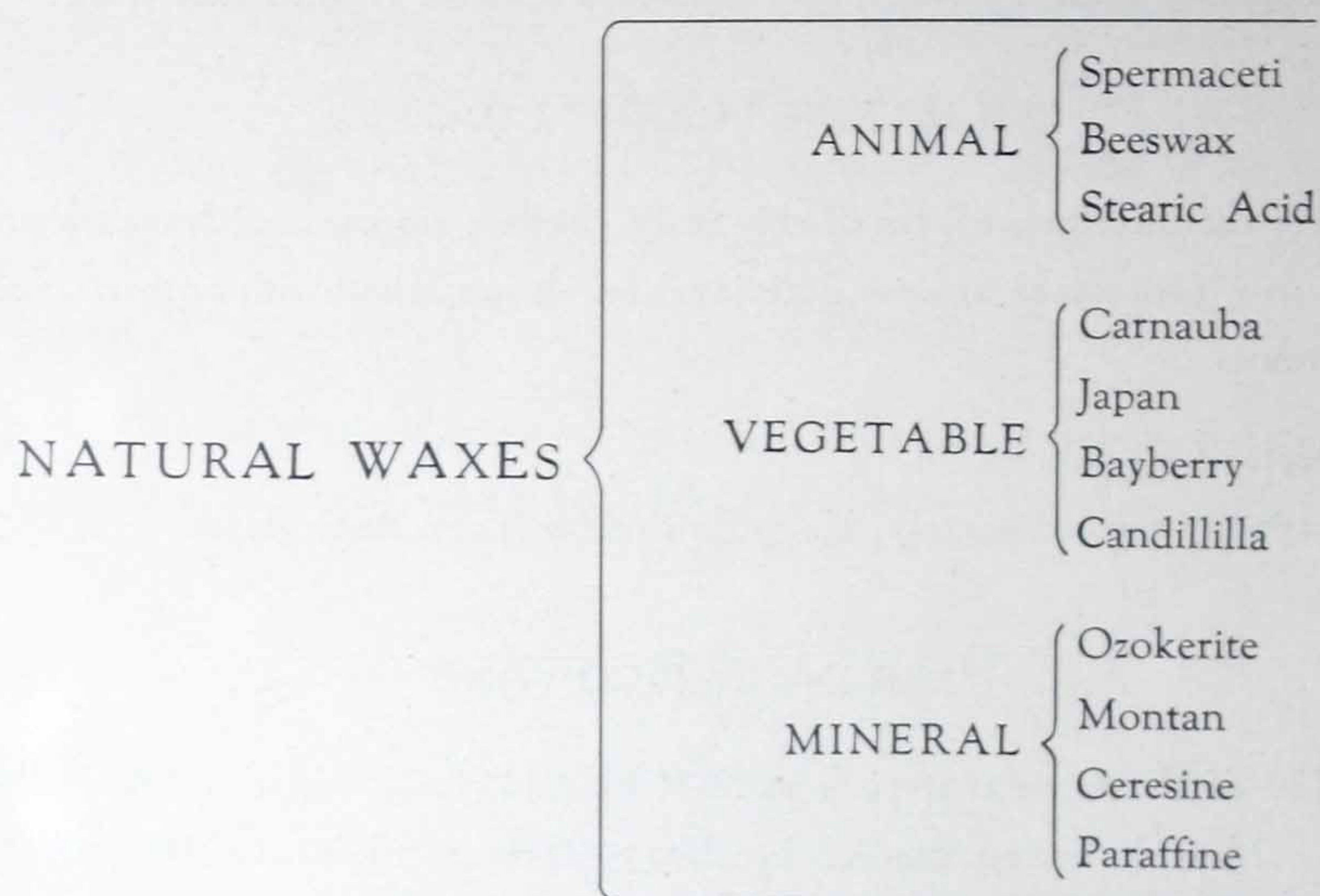


Chart of Natural Waxes of Commerce.

"The comprehension of the generic term wax is based in a considerable measure on the physical characteristics of the oldest known wax, namely, beeswax. It has been suggested that the term wax be defined as applied to more or less unctuous, fusible, variably viscous to solid substances, having a characteristic waxy lustre, which are in-soluble in water but usually soluble in carbon di-sulphide, benzol, etc., and which are extremely susceptible to changes in temperature and whose origin, composition and color are variable.

"Thus under this definition are included the class of waxy bodies which consist of mono or di-hydric alcohols united with the higher fatty acids to form esters (beeswax, carnauba wax, etc.), as well as glycerides of a waxy appearance, such for example as Japan wax and the hydrocarbon waxes, paraffine, ceresin, ozokerite and the like."

(Rodgers—Manual of Industrial Chemistry.)



## ANIMAL WAXES.

### BEESWAX.

Origin: This wax is secreted by the honey bee and is used by the bees in building up the cell walls of the honey comb. It is generally offered, for trade purposes, in its crude state, the color being of varying grades of yellow. It is the oldest known wax.

Characteristics: It is a plastic to semi-plastic wax.

Melting point, 140/45° F.

Specific gravity, 0.964 to 0.970.

Can be bleached to a white wax.

Production: It is produced in almost every country with type variances as to color, hardness and degree of tackiness. The domestic production is very small, the bulk of supplies coming from foreign countries.

Uses: Bleached Beeswax is used for cosmetics, medicinal and other purposes.

Yellow Beeswax is used for candles, compounding, substituting for ozokerite wax and various purposes.

### CHINESE INSECT WAX.

Origin: This wax is the secretion of an insect inhabiting a variety of evergreen tree found in China.

Characteristics: It is yellowish white in color, resembling spermaceti in appearance but is harder.

Melting point: 176° to 177° F.

Specific gravity: 0.926 to 0.970.

Uses: None is shipped to American markets.

### SPERMACETI.

Origin: This wax occurs in the head cavity and in the blubber of the sperm whale.

Characteristics: It is offered in its commercial form in solid blocks or in one to two-pound cakes. It is white and semi-white, is very crystalline in fracture; very brittle and can be very easily rubbed to a powder.

Melting point is 107° to 116° F.

Specific gravity: 0.905 to 0.960.

Production: Compared with other waxes its production is limited.

Uses: Used for candles and cosmetics.

### STEARIC ACID.

Origin: This article is produced by the saponification of tallow. It is offered as "single pressed," "double pressed" and "triple pressed," indicating the degree of the extraction of the oleaginous matter.

Characteristics: It is white in color and is of a dense, hard, close fractured consistency. Commercially put out in cakes.

Melting point: 126° to 130° F.

Specific gravity: 0.843.

Production: The production is very large. Substantial quantities are produced in United States.

Uses: Very largely used in candles, compounding and other purposes.



## VEGETABLE WAXES.

### BAYBERRY WAX.

Origin: This is a greenish wax derived from the berries of the bayberry, the source of which is peculiar to the Eastern territory of the United States.

Characteristics: It is a very fragrant wax and of saponifiable value. The green color can be bleached to white.

Melting point: 102° F. to 109° F.

Specific gravity: 0.964 to 0.970.

Production: Only small quantities are produced, probably not more than twenty tons yearly.

Uses: It is particularly favored by certain soap manufacturers and similar lines.

### CANDILLILLA WAX.

Origin: This wax is found as a coating on the entire surface of a certain Mexican shrub called the candillilla. It is extracted and refined by boiling and in steam tanks.

Characteristics: The impure wax is dark brown but the refined product is opaque to translucent with a brownish yellow color. It is harder than beeswax but not as hard as carnauba wax.

Melting point: 152° F. to 154° F.

Specific gravity: 0.983.

Production: The production is not very large but is increasing.

Uses: It is chiefly used as a substitute for carnauba wax and beeswax. Mixed with certain grades of ozokerite wax it makes a good molding compound for electrotypes.

### CARNAUBA WAX.

Origin: This is a hard brittle yellowish or brownish gray wax obtained from the leaves of a Brazilian palm tree. It is refined into several grades according to color and texture.

Characteristics: It is exceedingly hard in the texture, to a degree of brittleness. It possesses most remarkable qualities for producing a polish.

Melting point: 180° F. to 183° F.

Specific gravity: 0.990 to 0.999.

Production: This is a very important wax and the production runs into millions of pounds yearly.

Uses: Owing to its polishing qualities it is a most important wax for shoe polish and floor polish. Is also used for raising the melting point of soft waxes.

### JAPAN WAX.

Origin: This wax is derived from hard white tallow-like mass which surrounds the kernels of the berries of several varieties of sumach trees found in Japan and China.

Characteristics: As offered for sale the wax is semi-plastic, of a yellowish cream color.

Melting point: 118° F. to 127° F.

Specific gravity: 0.975.

Production: Exports from Japan amount to several million pounds per annum.

Uses: One of the principal uses is for laundry purposes. It is used as a constituent of various polishes and in finishing leather.



## MINERAL WAXES.

### MONTAN WAX.

Origin: This is a hard wax obtained from the distillation of the lignites found in Saxony and Thuringia.

Characteristics: It is of an exceedingly friable nature, brown to dark brown in color.

Melting point: 176° F. to 195° F.

Specific gravity: 1.013 to 1.021.

Production: Its production is very large as it is an article of considerable value.

Uses: Used largely as a substitute for carnauba wax in the manufacture of polishes, etc., and as an insulating material.

### OZOKERITE.

Origin: Ozokerite, or earth wax, is a wax-like substance found in small quantities throughout the world, usually associated with rock salt or gypsum. The principal deposit occurs in the neighborhood of Borgslaw in Galicia. It consists largely of solid paraffine hydrocarbons and is supposed to have resulted from the evaporation and decomposition of crude petroleum.

Characteristics: It occurs in several grades, some being soft and plastic and others brittle.

The color ranges from a greenish brown to a black.

Melting point: 130° to 156° F.

Specific gravity: 0.850 to 0.890.

Production: The production, almost wholly from Galicia, prior to the war was large, but ample for the demand.

Uses: Used principally as an insulating wax and other allied purposes.

### CERESINE.

Origin: It is a refined ozokerite. Ozokerite after treatment with sulphuric acid, washing and neutralization with caustic soda, is filtered through bone black or fullers earth.

Characteristics: It is of an inodorous white appearance and is colored to varying shades of yellow, orange, etc. Melting points and specific gravity same as ozokerite.

Production: Produced in good quantities, prior to the war, but not in as large quantities as ozokerite.

Uses: It is used as a substitute for beeswax, in cosmetics, candle making and in insulation.

### PARAFFINE.

Origin: Paraffine is a translucent waxy material of lamino-crystalline structure, and is obtained from petroleum, shale oil and lignite. The principal source is petroleum and the East Indian petroleums produce the highest melting points.

Characteristics: The crude wax is white or yellow in color and runs in melting point from about 104° F. to 128° F. It contains a certain percentage of oil and moisture. It is sometimes known as "scale wax" and is generally shipped in wood barrels. The refined wax is water white in color, the oil and moisture being eliminated in the refining process. Generally moulded in cakes and shipped in bags or cases. The melting points run from 118° F. to 140° F.

Production: The production is extremely large and its manufacture and sale is a very important trade.

Uses: Its uses are almost unlimited. It is used for making waxed paper, candles, insulating work, lubricants, ointments, dressings, waterproofings, etc.



## SYNTHETIC WAXES.

In order to provide low-priced substitutes for certain natural waxes we have developed a number of synthetic products.

### COMMERCIAL CERESINE WAX.

This is a wax product which has the appearance and some of the characteristics of pure ceresine and is used for identical purposes.

Made in several melting points: 130°-133° F., 133°-135° F., 135°-138° F., 140°-145° F., and 150°-160° F.

Colors: Lemon, Yellow, Orange and White.

The wax is moulded in cakes, weighing about 55 pounds each and packed three cakes to a bag, approximately 160 pounds. Double bags are used, a cotton lining and an outside bag of burlap. The size of the bag is about 14"x15"x31".

### SYNTHETIC OZOKERITE

In making Synthetic Ozokerite we have not tried to duplicate all varieties of native Ozokerite, but rather to make synthetic compounds that will work best for various uses. We furnish several grades, from a plastic compound that can be used in making electrotyper's moulds, to a hard polishing wax.

These compounds resemble native Ozokerite closely as to melting point, viscosity, specific gravity, etc., and will impart approximately the same polish and texture to mixtures as can be obtained by the use of the natural wax.

These waxes are moulded in cakes weighing about 55 pounds and are packed 3 cakes to a bag, weighing approximately 165 pounds. The size of the bags is about 14" x 16" x 31".

### COMMERCIAL MONTAN WAX.

This wax is made to be used for purposes where pure montan wax is used and shows comparative tests as follows:

MONTAN WAX.		SYNTHETIC MONTAN.	
Melting Point: 183° F.		Melting Point: 175° to 180° F.	
Viscosity at:		Viscosity at:	
290° F. ....	1.4824	290° F. ....	1.5345
250° F. ....	1.7241	250° F. ....	1.8448
210° F. ....	2.0862	210° F. ....	2.6370
Penetration Test at:		Penetration Test at:	
70° F. ....	0.0	70° F. ....	0.0
100° F. ....	0.0	100° F. ....	0.0
120° F. ....	0.0	120° F. ....	0.0
140° F. ....	2.5	140° F. ....	23.0
Specific Gravity at:		Specific Gravity at:	
60° F. ....	1.0017	60° F. ....	0.9425

The wax is moulded in cakes, weighing about 55 pounds each and packed three cakes to a bag, weighing approximately 160 pounds. Size of bags is about 14" x 15" 31".



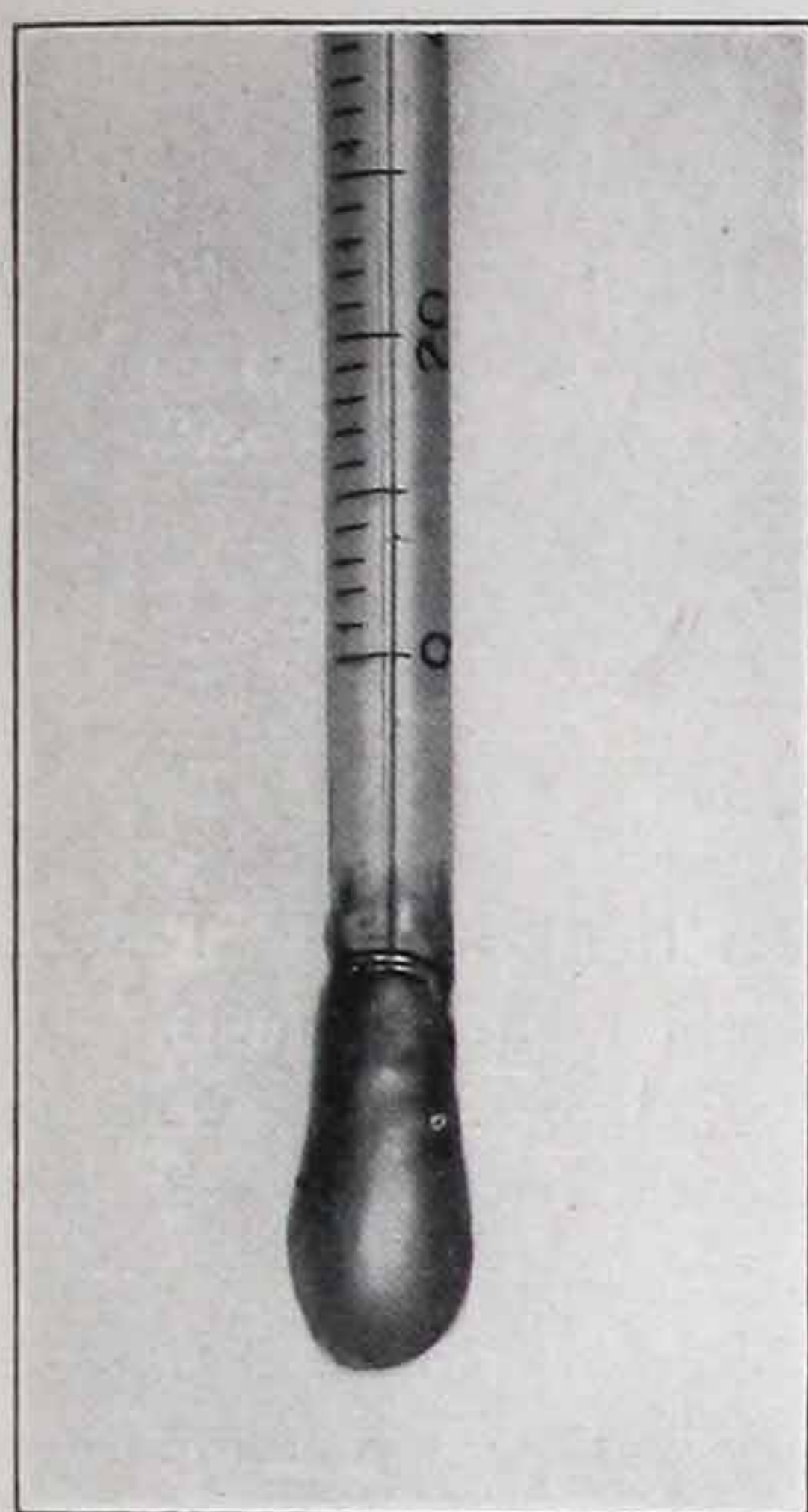


Fig. 1.

## MELTING POINTS AND HOW TO TAKE THEM.

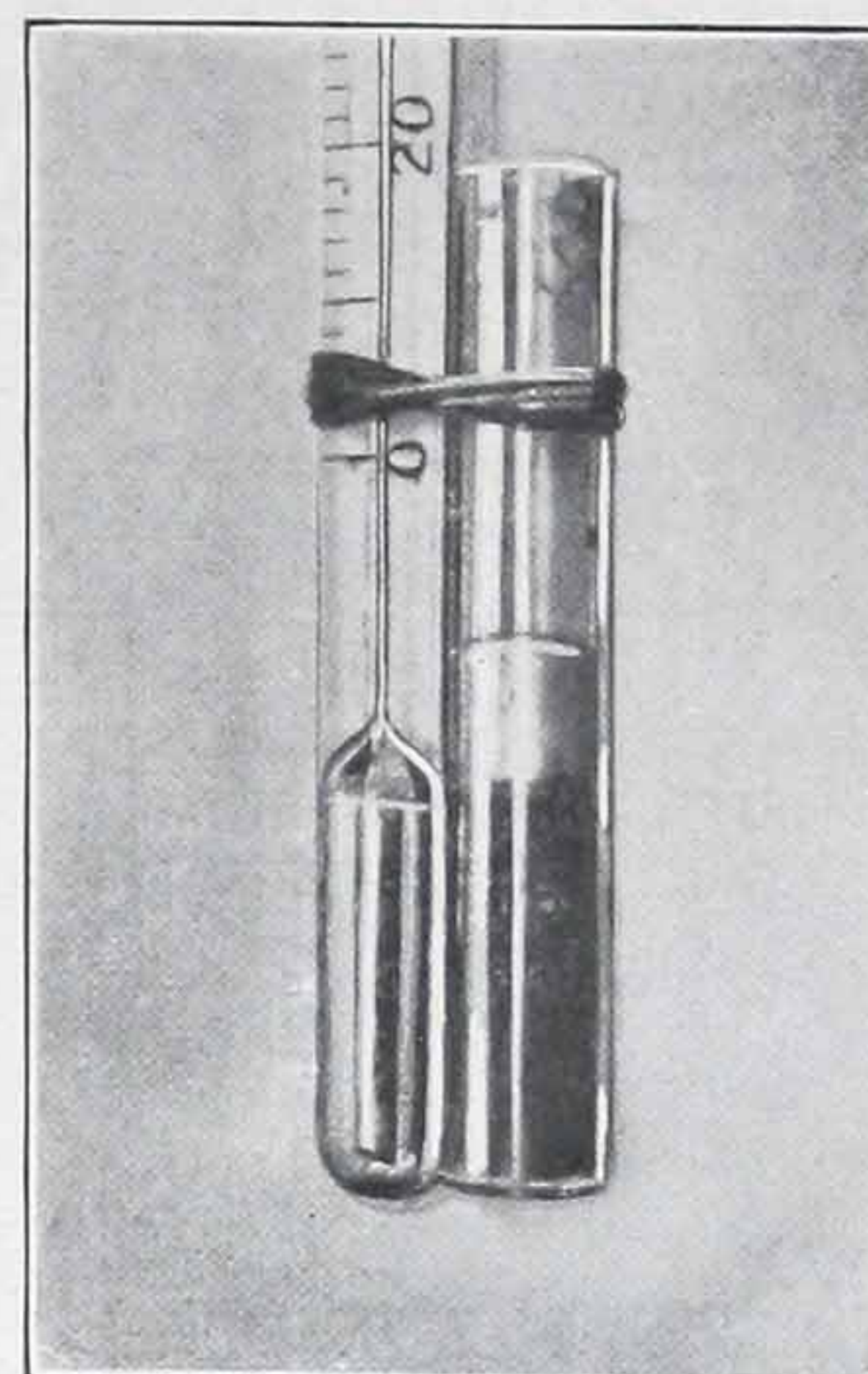


Fig. 2.

The difficulty in taking the melting point of an asphalt, a pitch, or an asphalt and pitch mixture, which does not crystallize on solidifying, is the fact that there is no line of demarcation between its solid state and its liquid state. Therefore any melting point claimed on a material of this class depends on the method employed. It is desirable, in view of this, that a standard method be adopted, so that if the same material is tested by a number of individuals the result will be approximately the same, if the same conditions are always observed. We are illustrating the apparatus and describing the three most popular methods, so that anyone can easily ascertain a melting point without recourse to a chemist or a technical expert. These three methods are the Columbia, sometimes known as the "drop" method, the Kraemer and Sarnow, generally called the "K. & S." method, and the Ball and Ring method.

The most important condition to be observed in taking the melting point by any method is the rate of heating. From four to six degrees Fahrenheit per minute has been taken as the standard and a variation from this standard will give variable results. Approximately the same amount of material should be used in each test and the temperature of the heating bath should be the same at the beginning of each test.

### COLUMBIA METHOD.

An inch test tube is supported in the center of a beaker. The beaker contains sulphuric acid, a strong solution of calcium chloride or cottonseed oil. Sufficient of the material to be tested is melted in a small dish and the bulb of the thermometer is coated with a layer about  $\frac{1}{8}$  of an inch in thickness, see figure No. 1. The thermometer is suspended in the center of the test tube, care being taken to see that the coated bulb does not get in contact with the sides or bottom of the test tube. The beaker which is supported on a wire gauze or asbestos plate, is heated by an alcohol or a bunsen flame, so regulated that the temperature rises about four to six degrees Fahrenheit per minute. The temperature at which the drop of the material falls from the bulb of the thermometer is taken as the "melting" point, "dropping" point or "flowing" point.

### KRAEMER & SARNOW METHOD.

The K. & S. method employs practically the same apparatus, but instead of coating the bulb of the thermometer as in the Columbia method, see figure No. 1, the material to be tested is in a small glass tube attached to the thermometer, see figure 2. A sufficient amount of the product to be tested is melted in a small dish. A piece of glass tubing having an internal diameter of about one quarter of an inch is dipped in the melted material until the tube is filled for about one-half inch from the bottom. By closing the top



of the tube tightly with the finger the material will not run out of the tube when it is lifted out of the melting dish and the tube is then placed in cold water and chilled below the solidifying point of the material. The excess is scraped off of the outside of the tube and on top of the half inch plug, which is inside the tube, is poured a quarter of an inch of mercury. The tube is fastened by a rubber band to the bulb of the thermometer, see figure 3, which is immersed in beaker containing sulphuric acid, solution of calcium chloride or cottonseed oil. The beaker is heated at a uniform rate of from four to six degrees Fahrenheit per minute. The temperature at which the plug softens sufficiently to allow the mercury to drop through is taken as the "melting" point.

### RING & BALL METHOD.

This method is proposed by the American Society of Testing Materials under the heading—"Tentative Method for the Determination of the Softening Point of Bituminous Materials other than Tar Products."

Apparatus consists of "a brass ring  $\frac{5}{8}$  inch in diameter,  $\frac{1}{4}$  inch deep, and with  $\frac{3}{32}$  inch wall, suspended one inch from the bottom of a beaker or about 600 c.c. capacity, a steel ball  $\frac{3}{8}$  inch in diameter and weighing between 3.45 grams, and a standardized thermometer."

"Carefully melt the sample and fill the ring with the material to be tested. Remove any excess. Place the ball in the center of the ring and suspend in the beaker containing 400 c.c. of water at a temperature at least 25° F. lower than the fusing point of the sample to be tested. Arrange the thermometer bulb within one-half inch of the sample and at the same level. Apply heat uniformly over the bottom of the beaker in a quantity sufficient to raise the temperature exactly 9° F. per minute. The rate of heating is very important. The softening point is the temperature at which the specimen has dropped one inch. Separate tests should average within 5° F. For materials with fusing points above 200° F. use glycerine instead of water."

A series of tests conducted by H. Abraham indicated that the Ball and Ring fusing points range 15° F. to 20° F. higher than those obtained by the Kraemer and Sarnow method. This relationship holds true regardless of whether the fusing point of the material is low or high.

### WAXES.

Waxes which crystallize on cooling have a well defined point at which the crystallization occurs and the English method of testing paraffine wax is taken as standard. It is as follows:

A vessel containing melted paraffine wax is put on a plate or other apparatus which rotates quite rapidly and at a uniform rate, so that the cooling process is hastened and kept as nearly uniform as possible. A thermometer is suspended with the bulb submerged in the liquid, and remains stationary while the vessel containing the wax rotates. At first the mercury falls steadily and quite rapidly as the wax steadily cools. When it nearly reaches the congealing point, however, it will be noticed that the steady and rapid fall of the mercury is suddenly arrested, and after pausing for a moment or two, again begins the fall—but more slowly. The temperature when the rapid and uniform fall of the mercury ceases for a moment is taken as the "melting" point. This point is very accurate, checking within a quarter of a degree.

The accuracy of this method is based on the latent heat of crystallization; that is, as the wax cools to such a point that it begins to form crystals, there is a moment when the heat is not given off, but is absorbed in the process of forming crystals and at that point the temperature is practically stationary, as shown by the stopping of the mercury column.

The American method which is standard in the United States is not as accurate as the English, but requires practically no apparatus. It is as follows:

Melt the paraffine wax to be tested in an open dish or vessel, take a round bulb thermometer and partially submerge the bulb in the surface of the melted wax. As the wax cools, small spots will appear on the surface of the wax, having the appearance of oil spots, and gradually these spots will multiply and form a thread-like connection. When these thread-like connections form, take the thermometer reading and add one degree. (The reason for adding one degree to the reading is that all of the mercury column should be in contact with the heated liquid in order to show the proper amount of expansion, but, of course, since the bulb is partially submerged part of the mercury is not heated to the temperature of the wax, and hence one degree added to the reading point will make up for this margin of error.

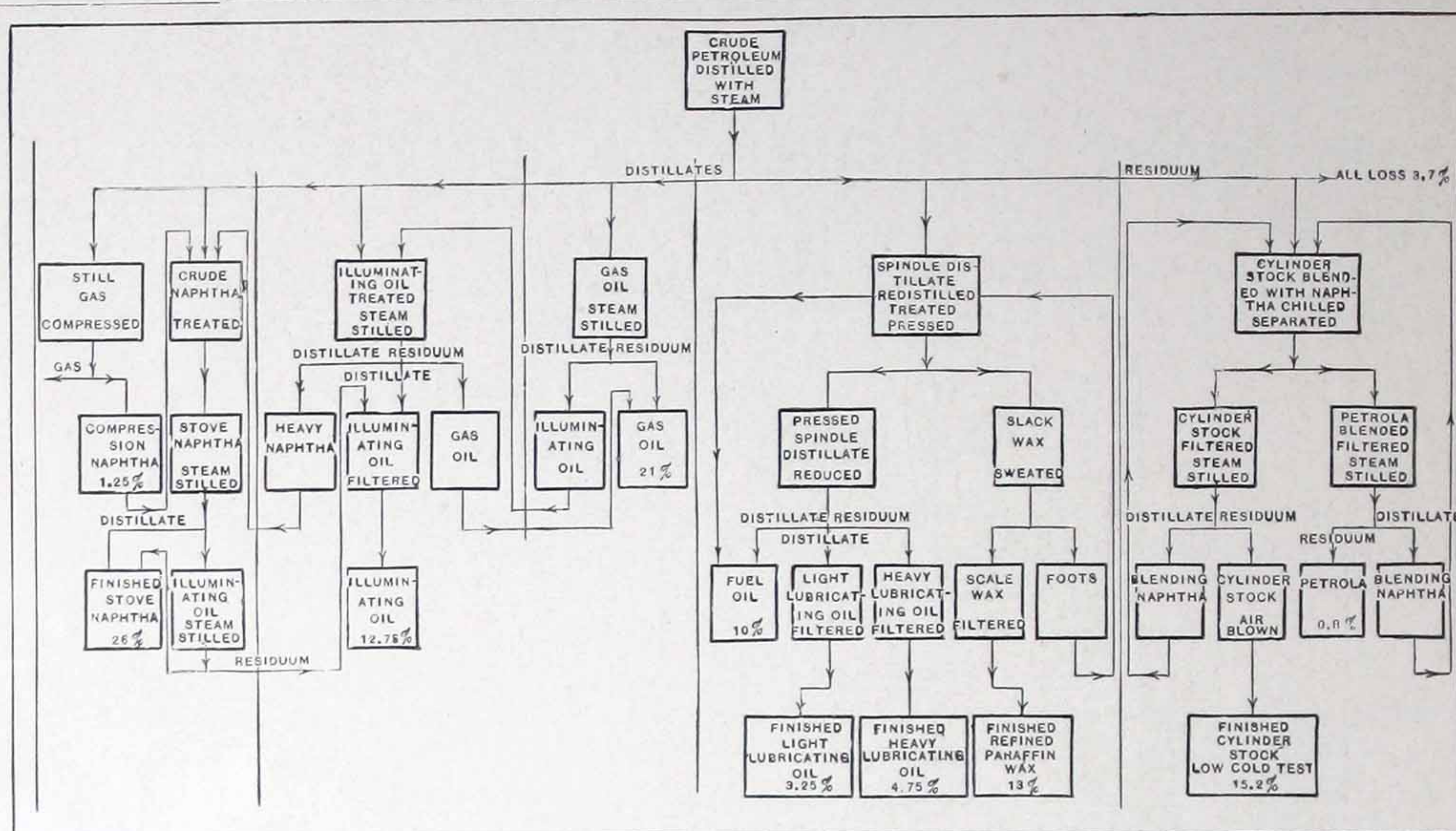
The American melting point is three points higher than the English.



# CHART OF BITUMINOUS SUBSTANCES.

BITUMINOUS SUBSTANCES	NATURAL	BITUMENS	GASEOUS	{ Natural Gas Marsh Gas	
			LIQUID OR SEMI- LIQUID	{ PETROLEUMS { Paraffin Base Asphaltic Base Mixed MALTHAS	
				MINERAL WAXES	{ Ozokerite (Ceresine) Montan Wax Hatchettite
		SOLID		MINERAL PITCHES	{ ASPHALT { Pure Calcareous Siliceous Earthy ASPHALTITES { Gilsonite Glance Pitch Manjak Grahamite
				OCCUR FAIRLY PURE	{ DERIVED FROM ASPHALTITES { Elaterite Albertite Impsonite DERIVED FROM VEGETABLE GROWTHS { Peat Lignite Bituminous Coal Anthracite Coal
	ARTIFICIAL	PYRO- BITUMENS	SOLIDS	MINERAL MATTES PREDOMINATE	{ Bituminous Shists Bituminous Shales
		ANIMAL ORIGIN	FROM BONES	{ Bone Tar Bone Tar Pitch	
			FROM FATS	FATTY ACID PITCHES	{ Stearin Pitch Stearin-Wool Pitch Wool Fat Pitch Palm Oil Pitch Cotton Seed Oil Pitch Cotton Oil Foots Pitch
		VEGETABLE ORIGIN	FROM VEGETABLE OILS		
			FROM CONIFERAE	{ Pine Tar Pine Tar Pitch	
			FROM HARD WOODS	{ Wood Tar Wood Tar Pitch	
		MINERAL ORIGIN	FROM PETROLEUM	{ Water Gas Tar and Water Gas Tar Pitch Sludge Pitch Petroleum Asphalts and Pitches Blown or Oxidized Asphalt	
			MALTHAS	Asphaltum	
			OZOKERITES	Paraffines	
			PEAT	Peat Tar and Peat Tar Pitch	
			LIGNITES	Lignite Tar and Lignite Pitch	
			BITUMINOUS COAL	{ Coal Tar and Tar Pitch Coke Oven Tar and Coke Oven Tar Pitch Blast Furnace Tar and Pitch Water Gas Tar and Water Gas Tar Pitch Generator Gas Tar and Pitch	
			ELATERITE	Elaterite Pitch	
			BITUMINOUS SHALES	{ Shale Oil Shale Oil Pitch	





Tide Water Oil Co.

REFINING CHART OF PENNSYLVANIA PETROLEUM

## PROCESS OF REFINING CRUDE PETROLEUM.

In the process of refining Crude Petroleum the crude oil is pumped into a large cylindrical boiler called a "crude still." When this is filled to a proper level, fires are started underneath and vaporization and distillation commence. The first stage of refining divides the oil into five groups, as follows: Crude Gasoline Distillate, Crude Illuminating Oil Distillate, Gas Oil Distillate, Lubricating Oil and Wax Distillate and Cylinder Stock Residuum.

The Crude Gasoline Distillate is pumped from the running tank to an agitator where it is treated with sulphuric acid, washed with water to remove the free acid and neutralized with caustic soda, again washed and separated from the water. The treated gasoline is next sent to a steam still where it is divided by distillation into various market grades of gasoline and pumped from there to the finished gasoline storage tanks.

The Crude Illuminating Oil Distillate is pumped to a steam still where the crude gasoline contained is separated by distillation and sent to the crude gasoline agitator. The illuminating oil remaining is sent to an agitator where it is acid treated, washed, neutralized, rewashed and filtered through Fuller's earth and pumped to the finished kerosene storage tanks.

The Gas Oil Distillate is redistilled to separate the illuminating oil content still remaining from the first distillation.

The Crude Lubricating Oil Distillate passes from the running tank to a steam and fire still for the purpose of changing (by heat) the character of the paraffine wax from the amorphous condition to wax that may be crystallized. The lubricating distillate then passes to an agitator where it is given an acid and alkali treatment and thoroughly washed with water. From the agitator it goes to a chilling tank where its temperature is lowered to such a degree as to cause crystallization of the wax. In this chilled condition

it is then pumped to a wax filter press, under high pressure, where it is separated into crude scale wax and pressed lubricating distillate. The pressed distillate then goes to a steam and fire still, where the gas oil is separated from it. The remaining distillate is then divided into lubricating oils of different viscosities, varying from very light to medium, by fractional distillation. The oils of different viscosities resulting from this fractional distillation are next sent to a Fuller's earth filter for the removal of color bearing compounds and free carbon. From the filter, these oils are pumped to the finished lubricating oil storage tanks. The crude scale wax is sent from the wax filter press to a sweater, where it is separated into scale wax and oil (foots). The scale wax then goes to a Fuller's earth filter, through which it passes to the finished paraffine wax tanks.

The Crude Cylinder Stock, being very viscous and difficult to handle, is greatly thinned down by mixing it with blending naphtha, and the solution is then sent to a chilling tank where the amorphous paraffine wax (crude petrola) from which vaseline is manufactured, settles out. This separation of petrola from all grades of oil has the effect of lowering the cold test. The cylinder stock-naphtha solution is separated and pumped to a Fuller's earth filter for the removal of color bearing compounds and free carbon. From the filter it passes on to a steam still where it is separated into naphtha and low cold test cylinder stock. From the still the oil is sent to a tank where it is blown with air to remove traces of moisture. After this air drying process, the cylinder stock is pumped to the finished storage tanks.

This description is a general one and the final products show some variation due to the nature of the original crude oil and the method of fractionation. Some products not shown on the accompanying diagram are obtained by a different fractionation.







